I Baden

Wildbad

THE

Diversions of Euler;

OR,

MENTAL CALCULATION:

BEING AN ANALYTICAL INVESTIGATION

OF THE

PHILOSOPHY OF NUMBERS.

Part First.

BY B. BOWER.

"Fretus vestrâ intelligentiâ, dissero breviùs quàm causa desiderat."—CICERO.

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This work was first announced to the public under the Title of the MENTAL CALCULATOR, *but another work under this Title (though totally different to this,) and the advice of friends have caused the Author to change the Title to the present one. Leonard Euler was a well known Character as a Calculator mentally. As far as the sixth power of all numbers, from* 1 *to* 100, *the figures were stamped on his memory. Like Homer, Milton and Saunderson, he was blind the latter part of his life, but during his Privation of sight he seemed to enjoy additional Vigour of Intellect. Figures and Calculation were his chief delight; but Virgil's Ænead is said to have been as familiar to him as the Alphabet of the English Language.*

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PREFACE.

We have frequently both heard and read of persons being able to return immediate and correct answers to questions, which are complex and difficult for mental calculation. A young boy of the name of George Noakes, aged six years, lately surprised his audience for the quick and exact answers he returned to all questions proposed to him; he also explained his mode of mental calculation as well as he could,—others of still more surprising attainments have not been able to explain their method so clearly, and some not at all. I am told there lives an idiot on the borders of Scotland who can return answers in this way, but who obstinately refuses to explain his mode of performance—indeed it is supposed he cannot.

The following is an attempt to simplify the mode of mental calculation, which the Author has found of great service in his own School. It is our practice, every Thursday afternoon, to dictate a piece of poetry or prose, and while the younger Pupils are pointing the same, and marking the parts of speech,—(generally substantives for them,) the elder Pupils are employed in mental calculation.

Any system which enables youth to think and execute accurately is worthy of notice, and, as such, I introduce this work upon the public, who, I trust, will deem it worthy of their patronage.

I do not pretend it will make dunces into bright geniuses, but whoever devotes proper attention to it, will be enabled to calculate mentally, with accuracy and expedition. And who has not to calculate mentally every day of his life? who has not to buy his victuals? who has not to buy his clothing?

From the first magistrate in the land, to the meanest beggar, some plan of mental calculation is daily made use of. The Author has not the presumption to say, that the same, or some similar method, is not made use of by tradesmen who have need of hourly calculation. *Necessitas omnium artium est mater.* And persons of no education may be found, who are remarkably clever at mental calculation. Necessity compelled such to strike out some plan which they found every way adequate to their wants, and they may have tenaciously adhered to it until practice and perseverance have rendered it certain and easy.

What their plans of calculation may be, I know not, nor have I seen in any school, or in any treatise, any thing on the subject. If any system can enable the merchant and manufacturer, to sell any quantity of goods without mistake, it must be worthy his serious attention. If a system can be adopted which will apply to

every business, and every species of calculation, it must be worthy of general attention. How far the proposed system is worthy of public patronage, the Author must leave for their decision.

The Author does not intend this performance to supplant any other. His design is to aid youth in thinking for themselves, and to exculpate teachers from blame, when parents propose simple questions to their children. But he would particularly recommend this system of Mental Calculation to all teachers;—Boys in general make a bungling beginning when taken into the counting-house;—and some seem as if they knew nothing, and as if all their schooling had been to no purpose; but let boys be practised, once a week, in Mental Calculation, and let a copy be neatly written, in the form of a Bill of Parcels, or Invoice, and the school shall divide the credit with the counting-house—the master's exertions, and the boy's labour, on the slate, shall not appear all and altogether in vain.

Mental Calculation sharpens the intellect, quickens the parts, enlarges the views, strengthens the mental powers, stimulates emulation, and makes dry calculation seem pleasing and inviting, and effectually anticipates the business of the counting-house. Should this small treatise meet the public approbation, a more enlarged and complete edition shall, in due time, be submitted to their perusal.

TO THE READER.

I do not present myself to the public as a great and splendid genius, capable of performing wonders, but of communicating little. If I were such, what would be the use of my production? I come forward as a plain practical man, as far as I go, using simple means to accomplish my ends, and to understand each other. John Bull likes something plain, practical, and useful; and you may each use the same means as myself, without one farthing's expense. These means may assist you in a waking hour, in your commercial calculations. I go the same way to all my calculations, namely, by hundreds, thousands, tens of thousands, hundreds of thousands, millions, and billions, if I need them. This way will, by a very little experience, become as well known to you as the way to your warehouses, your factories, and the church. I do not use different means to every operation, but always the same. I use no instrument or machines,—but the grand machine which all possess, without purchase,—the human head. Of this head you know the use as well as myself, and perhaps better. The reason of my presuming to address you is this, that some of you may not have directed your thoughts this way, and others may have been very differently employed; but my purpose will be fully answered, if any one among you be either benefitted or amused.

INTRODUCTION.

If you say six fours are twenty-four, you think it easy enough, but if you say six fourteens, or six twenty-fours, you think these somewhat harder; but let us try; six tens are sixty, and as above, six fours are twenty-four; add these together, and you have eighty-four; six twenties are one hundred and twenty, and six fours, as above, are twenty-four; add these two products together and you have one hundred and forty-four. In numbers as under:—

(1)	4	(2)	10		4		(3)	20	4
	6		6		6			6	6
	24		60	+	24	= 84		120	+ 24 = 144

The way I should teach this to be done may not appear to possess any advantage over the common way at first sight, but if we apply this system to larger numbers, the advantage will be more apparent and convincing. In the second example above, I would teach six ones are six, annexing the cipher in ten to the right hand of my product six. If I wished to multiply 100 by six, I would say the same, six ones are six, annexing two ciphers, and so on for 1000, 10,000, 100,000, annexing ciphers to my product of whole numbers, so that whatever I might have to multiply, would be just as easy as six fours, the first example.

Multiply 615 by 8.

6	× 8 =	4800	annexing two ciphers.
1	× 8 =	80	annexing one cipher.
5	× 8 =	40	
		4920	

In adding this, I should say in my own mind, 40 and 80 are 120, added to 4800, make 4920. From this it will evidently appear, that I divide a gross sum into its constituent parts. In multiplying 125 by 4, I would divide the gross sum to be multiplied into 100, and multiply by 4; into 20, and multiply by 4; and into 5, and multiply by 4, equal to 400, added to 80, added to 20, all equal to 500.

Bought 72 yards of cloth, at 7s. 6d. per yard, what have I to pay for the whole?

Before I commence the operation, let me observe that

8 half-crowns make a pound,
4 crowns make a pound,
2 half pounds a whole pound.

7s. 6d. can be divided into a crown and half-crown, I shall therefore have to give

72 crowns equal to 36 half pounds, equal to £.18
72 half-crowns equal to half of £18. equal to 9

Amount.....27 Ans.

20 pieces of cloth, each 45 yards, at 15s. per yard, what do they come to?

$20 \times 40 = 800$
$20 \times 5 = 100$

900 yards in the whole.

Divide 15 shillings into half a pound and a crown

900 half pounds, equal to....£.450 whole pounds.
900 crowns, equal to half £450..225

Amount.....675 of the whole.

In halving 450, say half 400 and half 50, and in adding 450 and 225, say 400 and 200 are 600, and 50 added to 20 added to 5, are equal to 75.

What come 25 pieces of printed cotton to, each 30 yards, at 1s. 9d. per yard?

Per piece.

s.	d.		£.	s.	d.
30	0	25 × 2 =	50	0	0
15	0	25 half pounds =	12	10	0
7	6	25 half crowns =	3	2	6
2	12	6	65	12	6

In this example it is plain I shall have to give for one piece, 30 shillings, 30 six-pences, and 30 three-pences, now

	£.	s.	d.
30 shillings are	1	10	0
30 six-pences are	0	15	0
30 three-pences are	0	7	6
	2	12	6 per piece.

	£.	s.	d.
25 times 2 make.....	50	0	0
25 half pounds make ..	12	10	0
25 half crowns make ..	3	2	6
	65	12	6

	£.	s.	d.
which add thus, 50 & 10 are 60 & 5 (2 & 3) =	65	0	0
and 10s. and 2s. 6d. =	0	12	6
	65	12	6

6000 oranges, at a penny per orange, what do they come to?

In this example, as 1000 oranges are equivalent in value to 1000 pence, I should ask how many pounds there are in 1000 pence. Now it is as easy to recollect that there are four pounds three shillings and four pence

in 1000 pence, as that 100 pence make 8s. 4d. or 50 pence 4s. 2d. therefore I should say

£4.	× 6 =	24	0	0
3s.	× 6 =	0	18	0
4d.	× 6 =	0	2	0
		25	0	0

or thus

12)6000 pence

500 shillings

and as 100 shilings make 5 pounds, 500 make 25 pounds. To a person acquainted with the Long Pence Table, all this explanation would be unnecessary.

24000 herrings, at a halfpenny each, what do they come to ?

24000 halfpence = 12000 pence.

N.B. 1000 pence = £4. 3s. 4d.

4 × 12 = £48. and if as in the last example, six times 3s. 4d. be equal to £1. twelve times that sum must be equal to £2. which added to £48. make £50. for the amount of the whole.

96000 yards of cotton, at 7d. per yard, what do they come to ?

According to the last question, 12000 pence make £50. therefore as many twelves as there are in 96, so many fifties will there be. By Division I see there are 8 twelves, therefore 50 × 8 = 400. Now, 96000 yards, at one penny per yard, would amount to £400. therefore at 7d. per yard, seven times £400. would amount to £2800. the value of the whole.

MENTAL NUMERATION.

Express in language the following figures.

Quadrillions Trillions Billions Millions Thousands

690,412,861,482,161,420,468,506,428,142. The succeeding periods are quintillions, sextillions, septillions, octillions, nonnillions, and decillions.

Thirty figures expressed in words, and it is evident I might have taken double the number as conveniently, but I leave this for the learner's practice, subjoining the names of every period (comprising six figures) as far as decillions, so that the learner may put down sixty-six figures at pleasure, and express them in language any time when he finds himself disposed.

Read the above thirty figures in the following manner:

Six hundred and ninety thousand, four hundred and twelve quadrillions, eight hundred and sixty-one thousand, four hundred and eighty-two trillions, one hundred and sixty-one thousand, four hundred and twenty billions, four hundred and sixty-eight thousand, five hundred and six millions, four hundred and twenty-eight thousand, one hnndred and forty-two.

Thirty figures extend beyond all practical purposes of utility, and even far enough for the gratification of curiosity.

Supposing a person to be able to count ten thousand penny pieces in one day, how long would a thousand be in counting a thousand billions?

10,000 penny pieces in one day.
365

In the year 3,650,000)1,000,000,000,000,000(200,000,000 (1000)
730 000 0
270 000 0
years 200,000 Ans.

From the above calculation, we perceive that a thousand persons would have to live two hundred thousand years without food, drink, or sleep, before they could have completed the task.

Taking the inhabitants of the globe to be about 800,000,000, how long would they be in counting a trillion of sovereigns at the same rate, and supposing them strung on a string, and ten in an inch, how many times would they reach round this globe?

10,000 sovereigns in one day.
365

1 yr. 3,650,000
all counting 800,000,000
1 yr. 2920,000,000,000,000)1,000,000,000,000,000,000(400 yrs.
1 168 000 000 000 000 0

Reckoning the globe 25,000 miles in circumference 15,840,000,000 sovereigns would reach round it.

15,840,000,000)1,000,000,000,000,000,000(60,000,000
950 400 000 00
times round.

From the above calculation, it would take all the inhabitants of the world to count almost 400 years, and the sovereigns would encircle the globe sixty millions of times.

Tables of Weights and Measures.

MULTIPLICATION TABLE,

Carried as far as 24.

The way to commit this Table to memory, is to multiply the left hand column by the Figures on the top.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144
13	26	39	52	65	78	91	104	117	130	143	156
14	28	42	56	70	84	98	112	126	140	154	168
15	30	45	60	75	90	105	120	135	150	165	180
16	32	48	64	80	96	112	128	144	160	176	192
17	34	51	68	85	102	119	136	153	170	187	204
18	36	54	72	90	108	126	144	162	180	198	216
19	38	57	76	95	114	133	152	171	190	209	228
20	40	60	80	100	120	140	160	180	200	220	240
21	42	63	84	105	126	147	168	189	210	231	252
22	44	66	88	110	132	154	176	198	220	242	264
23	46	69	92	115	138	161	184	207	230	253	276
24	48	72	96	120	144	168	192	216	240	264	288

MONEY.

HALF TABLE.

s	d.			s.	d.
0	0½	is ½	of	0	1
0	1½	is ½	of	0	3
0	3	is ½	of	0	6
0	6	is ½	of	1	0
0	7½	is ½	of	1	3
1	3	is ½	of	2	6
2	6	is ½	of	5	0
5	0	is ½	of	10	0
10	0	is ½	of	20	0

PARTS OF A POUND.

s.	d.	
10	0	is 1-half.
6	8	is 1-third.
5	0	is 1-fourth.
4	0	is 1-fifth.
3	4	is 1-sixth.
2	6	is 1-eighth.
2	0	is 1-tenth.
1	8	is 1-twelfth.
1	4	is 1-fifteenth.
1	3	is 1-sixteenth.

PENCE TABLES.

d.		s.	d.	d.		s.	d.	d.		s.	d.	d.		s.	d.
15	are	1	3	69	are	5	9	20	are	1	8	130	are	10	10
18	..	1	6	72	..	6	0	24	..	2	0	132	..	11	0
21	..	1	9	75	..	6	3	30	..	2	6	140	..	11	8
24	..	2	0	78	..	6	6	36	..	3	0	144	..	12	0
27	..	2	3	81	..	6	9	40	..	3	4	150	..	12	6
30	..	2	6	84	..	7	0	48	..	4	0	156	. .	13	0
33	..	2	9	87	..	7	3	50	..	4	2	160	. .	13	4
36	..	3	0	90	..	7	6	60	..	5	0	168	. .	14	0
39	..	3	3	93	..	7	9	70	..	5	10	170	. .	14	2
42	..	3	6	96	..	8	0	72	..	6	0	180	. .	15	0
45	..	3	9	99	..	8	3	80	..	6	8	190	. .	15	10
48	..	4	0	102	..	8	6	84	..	7	0	192	. .	16	0
51	..	4	3	105	..	8	9	90	..	7	6	200	. .	16	8
45	..	4	6	108	..	9	0	96	..	8	0	300	. .	25	0
57	..	4	9	111	..	9	3	100	..	8	4	400	. .	33	4
60	..	5	0	114	..	9	6	108	..	9	0	500	. .	41	8
63	..	5	3	117	..	9	9	110	..	9	2	600	. .	50	0
66	..	5	6	120	..	10	0	120	..	10	0	700	. .	58	4

LONG PENCE TABLE.

d.		£.	s.	d.	d.		£.	s.	d.
100	are =	0	8	4	10,000	are =	41	13	4
200	..	0	16	8	11,000	..	45	16	8
300	..	1	5	0	12,000	..	50	0	0
400	..	1	13	4	13,000	..	54	3	4
500	..	2	1	8	14,000	..	58	6	8
600	..	2	10	0	15,000	..	62	10	0
700	..	2	18	4	16,000	..	66	13	4
800	..	3	6	8	17,000	..	70	16	8
900	..	3	15	0	18,000	..	75	0	0
1,000	..	4	3	4	19,000	..	79	3	4
1,500	..	6	5	0	20,000	..	83	6	8
2,000	..	8	6	8	21,000	..	87	10	0
2,500	..	10	8	4	22,000	..	91	13	4
3,000	..	12	10	0	23,000	..	95	16	8
3,500	.	14	11	8	24,000	..	100	0	0
4,000	..	16	13	4	25,000	..	104	3	4
4,500	..	18	15	0	* 30,000	..	125	0	0
5,000	..	20	16	8	* 36,000	..	150	0	0
5,500	..	22	18	4	* 42,000	..	175	0	0
6,000	..	25	0	0	* 48,000	..	200	0	0
6,500	..	27	1	8	* 96,000	..	400	0	0
7,000	..	29	3	4	*192,000	..	800	0	0
7,500	.	31	5	0	*240,000	..	1000	0	0
8,000	..	33	6	8	*480,000	..	2000	0	0
8,500	..	35	8	4	*960,000	..	4000	0	0
9,000	..	37	10	0	*980,000	..	4083	6	8
9,500	..	39	11	8	1,000,000	..	4166	13	4

* Repeat the Omissions.

LONG SHILLINGS TABLE.

s.	£.	s.	£.	s.	£.
100are	=5	3,000are	=150	* 80,000are	=4,000
200..	10	4,000..	200	90,000 ..	4,500
300..	15	* 8,000..	400	100,000 ..	5,000
400..	20	*10,000..	500	*120,000 ..	6,000
500..	25	20,000..	1,000	*240,000 ..	12,000
1,000..	50	30,000..	1,500	*480,000 ..	24,000
2,000..	100	*60,000..	3,000	*960,000 ..	48,000

* Repeat the Omissions.

HALF CROWNS TABLE.

		£.			£.
8	halfcrowns are	=1	136	halfcrowns are	=17
16	.....	2	144	.....	18
24	.....	3	152	.....	19
32	.....	4	160	.....	20
40	.....	5	168	.....	21
48	.....	6	176	.....	22
56	.....	7	184	.....	23
64	.....	8	192	.....	24
72	.....	9	200	.....	25
80	.....	10	208	.....	26
88	.....	11	216	.....	27
96	.....	12	224	.....	28
104	.....	13	232	.....	29
112	.....	14	240	.....	30
120	.....	15	248	... ..	31
128	.....	16	256	.....	32

HALFCROWNS TABLE CONTINUED.

	£.		£.
264 halfcrowns are	=33	416 halfcrowns are	=52
272	34	424	53
280	35	432	54
288	36	440	55
296	37	448	56
304	38	456	57
312	39	464	58
320	40	472	59
328	41	480	60
336	42	488	61
344	43	496	62
352	44	504	63
360	45	512	64
368	46	520	65
376	47	528	66
384	48	536	67
392	49	544	68
400	50	552	69
408	51	560	70

TABLE OF EQUALS.

7½*d.*	1*s.* 3*d.*	2*s.* 6*d.*	5*s.*	10*s.*	£.
2272 are=	1136 are=	568 are=	284 are=	142 are=	71
2304 . .	1152 . .	576 . .	288 . .	144 . .	72
2336 . .	1168 . .	584 . .	292 . .	146 . .	73
2368 . .	1184 . .	592 . .	296 . .	148 . .	74
2400 . .	1200 . .	600 . .	300 . .	150 . .	75
2432 . .	1216 . .	608 . .	304 . .	152 . .	76
2464 . .	1232 . .	616 . .	308 . .	154 . .	77
2496 . .	1248 . .	624 . .	312 . .	156 . .	78
2528 . .	1264 . .	632 . .	316 . .	158 . .	79
2560 . .	1280 . .	640 . .	320 . .	160 . .	80

TABLE OF EQUALS CONTINUED.

7½d.	1s 3d.	2s. 6d.	5s.	10s.	£.
2592are=	1296are=	648 are=	324are=	162are=	81
2624 . .	1312 . .	656 . .	328 . .	164 . .	82
2656 . .	1328 . .	664 . .	332 . .	166 . .	83
2688 . .	1344 . .	672 . .	336 . .	168 . .	84
2720 . .	1360 . .	680 . .	340 . .	170 . .	85
2752 . .	1376 . .	688 . .	344 . .	172 . .	86
2784 . .	1392 . .	696 . .	348 . .	174 . .	87
2816 . .	1408 . .	704 . .	352 . .	176 . .	88
2848 . .	1424 . .	712 . .	356 . .	178 . .	89
2880 . .	1440 . .	720 . .	360 . .	180 . .	90
2912 . .	1456 . .	728 . .	364 . .	182 . .	91
2944 . .	1472 . .	736 . .	368 . .	184 . .	92
2976 . .	1488 . .	744 . .	372 . .	186 . .	93
3008 . .	1504 . .	752 . .	376 . .	188 . .	94
3040 . .	1520 . .	760 . .	380 . .	190 . .	95
3072 . .	1536 . .	768 . .	384 . .	192 . .	96
3104 . .	1552 . .	776 . .	388 . .	194 . .	97
3136 . .	1568 . .	784 . .	392 . .	196 . .	98
3168 . .	1584 . .	792 . .	396 . .	198 . .	99
3200 . .	1600 . .	800 . .	400 . .	200 . .	100

AVOIRDUPOIS WEIGHT.

			MARKED.
16 drams	are = 1	ounce.....	dr. / oz.
16 ounces	 1	pound	lb.
28 pounds	 1	quarter	qr.
4 quarters, or 112lb.	 1	hundred weight..	cwt.
20 hundred weight	 1	ton.....	ton.

Drams.				
16 =	1 Ounce.			
256 =	16 =	1 Pound.		
7168 =	448 =	28 =	1 Quarter.	
28672 =	1792 =	112 =	4 =	1 Cwt.
573440 =	35840 =	2240 =	80 =	20 = 1 Ton.

CLOTH MEASURE.

				MARKED.
$2\frac{1}{4}$ Inches	are = 1	Nail	.....	in. n.
4 Nails	 1	Quarter of a yard	..	qrs.
3 Quarters	 1	Flemish ell	.....	F. E.
4 Quarters	 1	Yard	.....	yd.
5 Quarters	 1	English ell	.....	E. E.
6 Quarters	 1	French ell	.....	Fr. E.

Inches.

$2\frac{1}{4}$ = 1 Nail.
9 = 4 = 1 Quarter.
36 = 16 = 4 = 1 Yard.
27 = 12 = 3 = 1 Flemish Ell.
45 = 20 = 5 = 1 English Ell.
54 = 24 = 6 = 1 French Ell.

LONG MEASURE.

				MARKED.
3 Barleycorns	are = 1	Inch	.....	bar. in.
12 Inches	 1	Foot	.....	ft.
3 Feet	 1	Yard	.....	yd.
6 Feet	 1	Fathom	.....	fth.
$5\frac{1}{2}$ Yards	 1	Rod, Pole, or Perch		rod. p.
40 Poles	 1	Furlong	.....	fur.
8 Furlongs	 1	Mile	.....	mile.
3 Miles	 1	League	.....	leag.
60 Miles	 1	Degree	.....	deg.

Barleycorns.

3= 1 Inch.
36= 12= 1 Foot.
108= 36= 3 = 1 Yard.
594= 198= $16\frac{1}{2}$= $5\frac{1}{2}$= 1 Pole.
23760= 7920= 660 = 220 = 40=1 Furlong.
190080=63360=5280 =1760 =320=8=1 Mile.

WINE AND SPIRIT MEASURE.

			MARKED.
2 Pints	are =	1 Quart.....	pts. / qts.
4 Quarts	....	1 Gallon	gal.
10 Gallons	....	1 Anker of Brandy	ank.
18 Gallons	....	1 Runlet	run.
31½ Gallons	....	Half a Hogshead ..	½ hhd.
42 Gallons	....	1 Tierce.....	tierce.
63 Gallons	....	1 Hogshead	hd.
84 Gallons	....	1 Puncheon	pun.
2 Hogsheads	....	1 Pipe or Butt..	p. or butt.
2 Pipes, or 4 Hhds.		1 Tun..	tun.

Cubic Inches.

$34\frac{2}{3}\frac{1}{2}$	=	1	Pint.					
$69\frac{10}{32}$	=	2	=	1	Quart.			
$277\frac{1}{4}$	=	8	=	4	=	1	Gallon.	
$2772\frac{1}{2}$	=	80	=	40	=	10	= 1	Anker.
$4990\frac{1}{2}$	=	144	=	72	=	18	= 1	Runlet.
$11644\frac{1}{2}$	=	336	=	168	=	42	= 1	Tierce.
$17466\frac{3}{4}$	=	504	=	252	=	63	= $1\frac{1}{2}$ = 1	Hogshead.
23289	=	672	=	336	=	84	= 2 = $1\frac{1}{2}$ = 1	Puncheon.
$34933\frac{1}{2}$	=	1008	=	504	=	126	= 3 = 2 = $1\frac{1}{2}$ = 1	Pipe.
69867	=	2016	=	1008	=	252	= 6 = 4 = 3 = 2 = 1	tun

DRY MEASURE.

			MARKED.
2 Pints	are =	1 Quart.....	pts. / qts.
4 Quarts	....	1 Gallon.....	gal.
2 Gallons	....	1 Peck	pk.
2 Pecks	....	1 Strike	strike.
2 Strikes or 4 Pecks	....	1 Bushel.....	bush.
4 Bushels	....	1 Coom	coom.
2 Cooms, or 8 Bushels	....	1 Quarter	qr.
4 Quarters	....	1 Chaldron....	chald.
5 Quarters	....	1 Wey	wey.
2 Weys	....	1 Last	last.

Cubic Inches.

$277\frac{1}{4}$ = 1 Gallon.
$554\frac{1}{2}$ = 2 = 1 Peck.
1159 = 4 = 2 = 1 Strike.
$2218\frac{10}{100}$ = 8 = 4 = 2 = 1 Bushel.
$8872\frac{76}{100}$ = 32 = 16 = 8 = 4 = 1 Coom.
$17745\frac{1}{2}$ = 64 = 32 = 16 = 8 = 2 = 1 Quarter.
70 82 = 256 = 128 = 64 = 32 = 8 = 4 = 1 Chal.
$88727\frac{1}{2}$ = 320 = 160 = 80 = 40 = 10 = 5 = 1 W y.
177455 = 640 = 320 = 160 = 80 = 20 = 10 = 2 = 1 L.

TIME.

		MARKED.
60 Seconds	are = 1 Minute	″ / m.
60 Minutes	.... 1 Hour	hour.
24 Hours	.... 1 Day	day.
7 Days	.... 1 Week	week.
4 Weeks	.... 1 Month	mo.
13 Months, 1 day, 6 hours	1 Julian year	yr.

Seconds.

60 = 1 Minute.
3600 = 60 = 1 Hour.
86400 = 1440 = 24 = 1 Day.
604800 = 10080 = 168 = 7 = 1 Week.
2419200 = 40320 = 672 = 28 = 4 = 1 Month.

d. h. w.d.h.
31557600 = 525960 = 8766 = 365:6 = 52:1:6 = 1 Jul. yr.

d. h. m. ″
31556937 = 525948 = 8765 = 366:5:48:57 = 1 Solar yr.

MENTAL MULTIPLICATION.

Multiply by	Multipliers			Products		
30	10	20	30	300	600	900
	40	50	60	1200	1500	1800
	70	80	90	2100	2400	2700
	100	*90	80	3000	2700	2400
	70	60	50	2100	1800	1500

* Multiply alternately.

100	40	30	20	4000	3000	2000
	10	200	300	10000	20000	30000
	400	500	600	40000	50000	60000
	700	800	900	70000	80000	90000
	*800	700	600	80000	70000	80000
	500	400	300	50000	40000	30000

* Multiply alternately.

1,000	200	100	1,000	200,000	100,000	1,000,000
	2,000	3,000	4,000	2,000,000	3,000,000	4,000,00
	5,000	6,000	7,000	5,000,000	6,000,000	7,000,000
	8,000	9,000	10,000	8,000,000	9,000,000	10,000,000

10,000	12,000	24,000	36,000	12,000,000	24,000,000	36,000,000
	48,000	60,000	72,000	48,000,000	600,000,000	72,000,000
	96,000	90,000	80,000	96,000,000	900,000,000	800,000,000
	70,000	60,000	50,000	700,000,000	600,000,000	500,000,000
	40,000	30,000	20,000	400,000,000	300,000,000	200,000,000
	10,000	40	50	100,000,000	400,000	500,000

7	60	70	80	420	490	560
	90	100	120	630	700	840
	200	300	400	1,400	2,100	2,800
	500	600	700	3,500	4,200	4,900
	800	900	1,000	5,600	6,300	7,000

100,000	11,000	12,000	13,000	1,100,000,000	1,200,000,000	1,300,000,000
	15,000	16,000	17,000	1,500,000,000	1,600,000,000	1,700,000,000
	18,000	19,000	20,000	1,800,000,000	1,900,000,000	2,000,000,000
	11,000	22,000	23,000	2,100,000,000	2,200,000,000	2,300,000,000
	14,000	25,000	26,000	2,400,000,000	2,500,000,000	2,600,000,000

MODE OF OPERATION IN EXAMPLE 1.

(1) 30	(2) 30	(3) 30	(4) 30	(5) 30
10	30	90	80	50
300	900	2,700	2,400	1,500

(1) $3 \times 1 = 3$, after this put down the ciphers in 30 & 10, side by side. (4) $3 \times 8 = 24$ after these figures place the ciphers in 30 and 80 side by side, and so on for all the rest.

(1) 100	(2) 100	(3) 800	(4) 100
300	900	100	800
30,000	90,000	80,000	80,000

$1 \times 3 = 3$ to which add four ciphers, two in the 100 and two in the 300, all the rest undergo the same operation.

N. B. Alternately means either number for the multiplier.

(1) 1,000	(2) 1,000	1,000
8,000	5,000	10,000
8,000,000	5,000,000	10,000,000

In these examples you have only to mind the number of ciphers, and always divide them into periods of three for hundreds, thousands, millions.

(1) 10,000	(2) 10,000	(3) 96,000
60,000	30,000	10,000
600,000,000	300,000,000	960,000,000

All these examples come under the common multiplication table, taking proper count of ciphers. Whether I multiply 8 by 9 or 9 by 8 the product is the same as in the 3d. example, $96,000 \times 10,000$ is the same as $10,000 \times 96,000$ and more agreeable to the common rules of practice.

(1) 600	(2) 900	(3) 1,000	(4) 60
7	7	7	7
4,200	6,300	7,000	420

(1) 23,000	(2) 19,000	(3) 100,000
100,000	100,000	24,000
2,300,000,000	1,900,000,000	2,400,000,000

Multiply alternately—mind the number of ciphers and read the first example thus, two thousand three hundred millions.

			Multipliers			Products		
Multiply	2	by	2	3	4	4	6	8
	3		5	6	7	15	18	21
	4		8	9	10	32	36	40
	5		11	12	13	55	60	65
	6		14	15	16	84	90	96
	7		17	18	19	119	126	133
	8		20	21	22	160	168	176
	9		23	24	25	207	216	225
	10		26	27	28	260	270	280
	11		29	30	31	319	330	341
	12		32	33	34	384	396	408
	13		35	36	37	455	468	481
	14		38	39	40	532	546	560
	15		41	42	43	615	630	645
	16		44	45	46	704	720	736
	17		47	48	49	799	816	833
	18		50	51	52	900	918	936
	19		53	54	55	1007	1026	1045
	20		56	57	58	1120	1140	1160
	21		59	60	61	1239	1260	1281
	22		62	63	64	1364	1386	1408
	23		65	66	67	1495	1518	1541
	24		68	69	70	1632	1656	1680
	25		71	72	73	1775	1800	1825
	26		74	75	76	1924	1950	1976
	27		77	78	79	2079	2106	2133
	28		80	81	82	2240	2268	2296
	29		83	84	85	2407	2436	2465
	30		86	87	88	2580	2610	2640
	31		89	90	91	2759	2790	2821
	32		92	93	94	2944	2970	3008
	33		95	96	97	3135	3168	3201
	34		98	99	100	3332	3466	3410
	35		101	102	103	3535	3570	3605
	36		104	105	106	3744	3780	3816
	37		107	108	109	3959	3996	4033
	38		110	111	112	4180	4218	4256

EXAMPLES.

(1) Multiply 13 by 5 In this place divide the number into its component parts viz. 10 and 5 then multiply each separately thus,

10	3
5	5
50	+ 15 to add them say 50 + 10 = 60 and 5 = 65.

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(2) Multiply

23	24	25 by 9
9	9	9
180	180	180
27	36	45
207	216	225

In multiplying these numbers mentally say, nine twenties are 180 and nine threes are 27; to add them say 80 aud 20 are 100 + 100 = 200, and 7 = 207. Nine twenties are 180, & nine fours are 36; to add them say 80 and 30 are 110 + 100 = 210, + 6 = 216. Nine twenties are 180 and nine fives are 45; to add them say 80 and 40 = 120 + 100 = 220 + 5 = 225.

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(3) Multiply 25 by 71, 72, 73.

Multiply 71, 72, 73, by 100 and we have 7,100, 7,200, 7,300 and half of which products are 3,550, 3,600, 3,650, then halve them again, you will have the true required products, viz.

1,775, 1,800, 1,825.

N. B. Halve 100 and we have 50, halve again and we have 25, and proceed in the same way by the numbers above, or any other, after adding two ciphers to the right hand.

AVOIRDUPOIS WEIGHT.

			How many Ounces in			Products		
	oz.		*lbs.*	*lbs.*	*lbs.*	*oz.*	*oz.*	*oz.*
Multiply	16	by	2	3	4	32	48	64
			5	6	7	80	96	112
			8	9	10	128	144	160
			11	12	13	176	192	208
			14	15	16	224	240	256
			17	18	19	272	288	304
			20	21	22	320	336	352
			23	24	25	368	384	400
			26	27	28	416	432	448
			29	30	31	464	480	496
			32	33	34	512	528	544
			35	36	37	560	576	592
			38	39	40	608	624	640
			41	42	43	656	672	688
			44	45	46	704	720	736
			47	48	49	752	768	784
			50	51	52	800	816	832
			53	54	55	848	864	880
			56	57	58	896	912	928
			59	60	61	944	960	976
			62	63	64	992	1008	1024
			65	66	67	1040	1056	1072
			68	69	70	1088	1104	1120
			71	72	73	1136	1152	1168
			74	75	76	1184	1200	1216
			77	78	79	1232	1248	1264
			80	81	82	1280	1296	1312
			83	84	85	1328	1344	1360
			86	87	88	1376	1392	1408
			89	90	91	1424	1440	1456
			92	93	94	1472	1488	1504
			95	96	97	1520	1536	1552
			98	99	100	1568	1584	1600

Multiply 16, by the numbers 13, 14, 15, 16, 17, 18, 19, as follows ;—multiply 16, by the 10 in 13, and then by the 3, and add the two products together, thus,

16		16		
10		3		
160	+	48	=	208 Ans.

In adding, say 60 + 40 = 100, + 100 = 200, + 8 = 208.

The first series terminates at 25, when we obtain a number with two ciphers, if the multiplicand be even, (namely 400,) consequently, for 26 the product will be 416, for 27 it will be 432, for 28 it will be 448, for 29 it will be 464, for 30 it will be 480, for 31 it will be 496, and for 32, it will be 512. These products may likewise be obtained by addition, as under,

for 25	the product is	400
for 7	it is	112
32		512 amount as above.

and so on until we come to 50, when we obtain a product just double that for 25, namely 800, and consequently, the first product of the third series is 816, the second 832, the third 848, proceeding as in the second series. Youth cannot have too much practice in Mental Addition and Multiplication, and this will be found very easy and amusing employment. Whatever number you take for a multiplicand and multiply by 2, 3, 4, &c. until you arrive at 25, 50, 75, and 100, the operation is the same as described above, and the same plan must be pursued.—Likewise the sum of the products of any two numbers will be equal to the product of the sum of these numbers. Thus product for 24 = 384 for 56 = 869

for 32 = 512 for 14 = 224

56 896 70 1120

AVOIRDUPOIS WEIGHT CONTINUED.

			How many Pounds in			Products		
	lbs.		*cwts*	*cwts*	*cwts*	*lbs.*	*lbs.*	*lbs.*
Multiply	112	by	2	3	4	224	336	448
			5	6	7	560	672	784
			8	9	10	896	1008	1120
			11	12	13	1232	1344	1456
			14	15	16	1568	1680	1792
			17	18	19	1904	2016	2128
			20	21	22	2240	2352	2464
			23	24	25	2576	2688	2800
			26	27	28	2912	3024	3136
			29	30	31	3248	3360	3472
			32	33	34	3584	3696	3808
			35	36	37	3920	4032	4144
			38	39	40	4256	4368	4480
			41	42	43	4592	4704	4816
			44	45	46	4928	5040	5152
			47	48	49	5264	5376	5488
			50	51	52	5600	5712	5824
			53	54	55	5936	6048	6160
			56	57	58	6272	6384	6496
			59	60	61	6608	6720	6832
			62	63	64	6944	7056	7168
			65	66	67	7280	7392	7504
			68	69	70	7616	7728	7840
			71	72	73	7952	8064	8176
			74	75	76	8288	8400	8512
			77	78	79	8624	8736	8848
			80	81	82	8960	9072	9184
			83	84	85	9296	9408	9520
			86	87	88	9632	9744	9856
			89	90	91	9968	10080	10192
			92	93	94	10304	10416	10528
			95	96	97	10640	10752	10864
			98	99	100	10976	11088	11200
			101	102	103	11312	11424	11536

In multiplying 112 by 2, we say twice 100 = 200, and twice 12 = 24, which add to the 200, and we obtain 224.

Multiply 112 by 20, 21, 22, and in order to perform this mentally, I say in the first operation, twice 100 = 200, and twice 12 = 24, which I add to 200, and obtain the product 224, to which I affix the cipher to the right hand, and obtain 2240, and to save repetition, for the second product I will add 112, and I shall obtain 2352, and again, and I obtain 2464, for the third and last product.

Multiply 112 by 23, 24, 25 respectively, and as before I say twice 100 = 200, and twice 12 = 24, which I add to 200, and, affixing the cipher to the right hand, I obtain 2240, to which if 112 × 3 = 336 be added viz. by hundreds and tens thus, 200 + 300 = 500, and 40 + 36 = 76, I obtain 2000, and 500, and 76, or in figures, 2576; and for the sake of dispatch in this case let us add to this product 112, and we obtain 2688, the product for 112 × 24; and for the same reason, let us add 112 again to to the last product obtained, and we arrive at 2800, the product of 112 × 25. Let us call, this the termination of the first series. By this term I would be understood to include all the numbers from 1 to 25: for the second series, all numbers from 25 to 50: for the third series, all numbers from 50 to 75: and for the fourth series, all numbers from 75 to 100. The products of the second series may be obtained by inspecting the products of the first series, thus,—the first term 112, added to the last product of the first series, viz. 2800, makes 2912, and by advancing 100 every time, and looking at the products already obtained for 2, 3, 4, &c. to 25, you will obtain the products of the second series, as fast as you can possibly write the figures down; 2800 and 224 (the product for 2) make 3024; now advance 100, & look for the two last figures of the product for 3, and you may write down 3136.

LONG MEASURE.

Multiply	*in.* 36	by	How many Inches in *yds.*	*yds*	*yds*	Products. *in.*	*in.*	*in.*
			2	3	4	72	108	144
			5	6	7	180	216	252
			8	9	10	288	324	360
			11	12	13	396	432	468
			14	15	16	504	540	576
			17	18	19	612	648	684
			20	21	22	720	756	792
			23	24	25	828	864	900
			26	27	28	936	972	1008
			29	30	31	1044	1080	1116
			32	33	34	1152	1188	1224
			35	36	37	1260	1296	1332
			38	39	40	1368	1404	1440
			41	42	43	1476	1512	1548
			44	45	46	1584	1620	1656
			47	48	49	1692	1728	1764
			50	51	52	1800	1836	1872
			53	54	55	1908	1944	1980
			56	57	58	2016	2052	2088
			59	60	61	2124	2160	2196
			62	63	64	2232	2268	2304
			65	66	67	2340	2376	2412
			68	79	70	2448	2484	2520
			71	72	73	2556	2592	2628
			74	75	76	2664	2700	2736
			77	78	79	2772	2808	2844
			80	81	82	2880	2916	2952
			83	84	85	2988	3024	3060
			86	87	88	3096	3132	3168
			89	90	91	3204	3240	3276
			92	93	94	3312	3348	3384
			95	96	97	3420	3456	3492
			98	99	100	3528	3564	3600
			101	102	103	3636	3672	3708

From what I have said in the preceding table, we will commence our observations on Long Measure.

At the beginning of the third series in this table, the products of the first and second series may be obtained, as in the last table, either by multiplication, addition, or inspection, as the operator chooses.

The last product of the second series is 1800, answering for 36 × 50, therefore the succeeding one will be 1836, and by looking for the highest product in the column above 1800, we see 72, which added together, make 1872, 1908, &c. taking care to advance 100 when the column inspected advances 100, which in the product for 3, it does.

The author could here make a variety of entertaining observations on the two terminating figures of numbers multiplied by 25, but as they will easily suggest themselves to all who adopt this mode of strengthening and exercising their intellectual powers, he will only just remark that they will end with 25, one cipher, 75, or two ciphers, according to the numbers multiplied by 25, and this may soon be foretold.

Similar observations might be made on the products of numbers multiplied by 50 and 75; but he will refrain, and the learner may break the crust of this pie himself: thus

1	2	3	4
25	25	25	25
—	—	—	—
25	50	75	100
5	6	7	8
25	25	25	25
—	—	—	—
125	150	175	200

And so on.

Here we see the two terminating figures always the same in their respective rotations.

LONG MEASURE CONTINUED.

Multiply	yds. 1760	by	How many Yards in mi. 2	mi. 3	mi. 4	Products. yds. 3520	yds. 5280	yds. 7040
			5	6	7	8800	10560	12320
			8	9	10	14080	15840	17600
			11	12	13	19360	21120	22880
			14	15	16	24640	26400	28160
			17	18	19	29920	31680	33440
			20	21	22	35200	36960	38720
			23	24	25	40480	42240	44000
			26	27	28	45760	47520	49280
			29	30	31	51040	52800	54560
			32	33	34	56320	58080	59840
			35	36	37	61600	63360	65120
			38	39	40	66880	68640	70400
			41	42	43	72160	73920	75680
			44	45	46	77440	79200	80960
			47	48	49	82720	84480	86240
			50	51	52	88000	89760	91520
			53	54	55	93280	95040	96800
			56	57	58	98560	100320	102080
			59	60	61	103840	105600	107360
			62	63	64	109120	110880	112640
			65	66	67	114400	116160	117920
			68	69	70	119680	121440	123200
			71	72	73	124960	126720	128480
			74	75	76	130240	132000	133760
			77	78	79	135520	137280	139040
			80	81	82	140800	142560	144320
			83	84	85	146080	147840	149600
			86	87	88	151360	153120	154880
			89	90	91	156640	158400	160160
			92	93	94	161920	163680	165440
			95	96	97	167200	169960	170720
			98	99	100	172480	174240	176000
			101	102	103	177760	179520	181280

The number of yards in a mile may be divided into 1000, and 700, and 60, and the first line will run in the following manner, as you perform the first operation:—

1st. Column.—Twice 1000 = 2000, twice 700 = 1400, and twice 60 = 120; add them thus, 2000 and 1400 = 3400, and 120 = 3520.

2d. Column.—1000 × 3 = 3000, 700 × 3 = 2100, 60 × 3 = 180; add them thus, 3000 and 2100 = 5100, and 180 = 5280.

3d. Column.—1000 × 4 = 4000, 700 × 4 = 2800, 60 × 4 = 240. 4000 and 2800 = 6800, 240 = 7040. In this last operation add the hundreds first, which make up another thousand, add this to the six thousand, and you obtain 7000, to which add 40. Always mind to add thousands separately, hundreds separately, tens separately, and units separately. You will find this method extremely useful, and a safeguard against confusion.

Multiply 1760 by 25.

In this example proceed as in the first operation under this table, only mind to add the ciphers, because the two here is twenty when disjoined from the five. For the second operation say 1000 × 5 = 5000, 700 × 5 = 3500, and 60 × 5 = 300; add them as follows, 5000 and 3000 = 8000, 500 and 300 = 800, in all 8800, which added to 35200 = 44000, and consequently, for practice in mental addition the second series will be 45760, &c. &c. &c.

Or thus, since 25 is the one quarter of 100, multiply 1760 by 100, or in other words affix two ciphers to the right hand side of 1760, and halve the product twice, as we do to find the number of yards in a quarter of a mile, and you will obtain the same result as above, viz. 44000.

WINE MEASURE.

			How many Pints of Wine in			Products		
	pts.		*tns.*	*tns.*	*tns.*	*pints.*	*pints.*	*pints.*
Multiply	2016	by	2	3	4	4032	6048	8064
			5	6	7	10080	12096	14112
			8	9	10	16128	18144	20160
			11	12	13	22176	24192	26208
			14	15	16	28224	30240	32256
			17	18	19	34272	36288	38304
			20	21	22	40320	42336	44352
			23	24	25	46368	48384	50400
			26	27	28	52416	54432	56448
			29	30	31	58464	60480	62496
			32	33	34	64512	66528	68544
			35	36	37	70560	72576	74592
			38	39	40	76608	78624	80640
			41	42	43	82656	84672	86688
			44	45	46	88704	90720	92736
			47	48	49	94752	96768	98784
			50	51	52	100800	102816	104832
			53	54	55	106848	108864	110880
			56	57	58	112896	114912	116928
			59	60	61	118944	120960	122976
			62	63	64	124992	127008	129024
			65	66	67	131040	133056	135072
			68	69	70	137088	139104	141120
			71	72	73	143136	145152	147168
			74	75	76	149184	151200	153216
			77	78	79	155232	157248	159264
			80	81	82	161280	163296	165312
			83	84	85	167328	169344	171360
			86	87	88	173376	175392	177408
			89	90	91	179424	181440	183456
			92	93	94	185472	187488	189504
			95	96	97	191520	193536	195552
			98	99	100	197568	199584	201600
			101	102	103	203616	205632	207648

Some may think this mode of calculation useless and dry, but practice it a little, and you will not think it useless.

It will exercise your memory, strengthen your faculties, and the dryness of it will disappear.

There are various ways of rendering it amusing.

If I add any two products together, the sum will be the number representing the sum of the two multipliers; add for instance the products in this table for 27 and 30 and you will have the product for 57, and after you have arrived at 25, the end of the first series, you may easily obtain the succeeding products by the terminating figures and addition; and again you may obtain each succeeding product by adding the multiplicand to the last product. I would advise each of these three methods to be used, as well as the general one of multiplication.

Variety excites attention and relieves the mind, and whenever you find it very difficult, practise something easier, which will soon prepare you for something harder. In this table say twice 200 are 400, and twice 16 are 32, minding to multiply 16 at twice if you find it too hard at once, namely, twice 10 are 20, and twice 6 are 12, 20 and 12 are 32, and 4000 are 4032. I reccommend this for young pupils.

First method.—27 = 54432
30 = 60480

57 = 114912

Second method.—After 25 always advance 2000 every time, besides taking the two terminating figures of the first series.

Third method.—This is simply adding 2016 to every product for the next succeeding product.

DRY MEASURE.

Multiply	pts.	by	How many Pints in lsts	lsts	lsts	ducts pints.	pints.	pints.
	5120		2	3	4	10240	15360	20480
			5	6	7	25600	30720	35840
			8	9	10	40960	46080	51200
			11	12	13	56320	61440	66560
			14	15	16	71680	76800	81920
			17	18	19	87040	92160	97280
			20	21	22	102400	107520	112640
			23	24	25	117760	122880	128000
			26	27	28	133120	138240	143360
			29	30	31	148480	153600	158720
			32	33	34	163840	168960	174080
			35	36	37	179200	184320	189440
			38	39	40	194560	199680	204800
			41	42	43	209920	215040	220160
			44	45	46	225280	230400	235520
			47	48	49	240640	245760	250880
			50	51	52	256000	261120	266240
			53	54	55	271360	276480	281600
			56	57	58	288720	291840	296960
			59	60	61	302080	307200	312320
			62	63	64	317440	322560	327680
			65	66	67	332800	337920	343040
			68	69	70	348160	353280	358400
			71	72	73	363520	368640	373760
			74	75	76	378880	384000	389120
			77	78	79	394240	399360	404480
			80	81	82	409600	414720	419840
			83	84	85	424960	430080	435200
			86	87	88	440320	445440	450560
			89	90	91	455680	460800	465920
			92	93	94	471040	476160	481280
			95	96	97	486400	491520	496640
			98	99	100	501760	506880	512000
			101	102	103	517120	522240	527360

To commence, twice five thousand are ten thousand, twice one hundred are two hundred, and twice twenty are forty; in figures 10000 and 200 and 40 make 10240.

Multiply 5120 by 44, 45, 46, thus

5000 × 40 =	200000		5000 × 4 =	20000	
100 × 40 =	4000		100 × 4 =	400	
20 × 40 =	800		20 × 4 =	80	
	204800			20480	

and now add the thousands first, then the hundreds, then the tens, thus 204000 and 20000 are 224000, and 800 and 400 are 1200. which add to 224000, make 225200, to which add the 80; again

5000 × 5 =	25000
100 × 5 =	500
20 × 5 =	100
	25600

now 25000 added to 204000 make 229000, and 800 + 600 = 1400, make 230400; to which, for the sake of brevity here, and needless repetition, add 5120, and you obtain 235520 for the last product.

Observe the terminating figures forming themselves into periods, viz. 60, 20, 80, 40, 00; 60, 20, 80, 40, 00, &c.

TIME TABLE.

Multiply	*min.* 60	by	How many Minutes in *hrs.* 2	*hrs.* 3	*hrs.* 4	Products. *min.* 120	*min.* 180	*min.* 240
			5	6	7	300	360	420
			8	9	10	480	540	600
			11	12	13	660	720	780
			14	15	16	840	900	960
			17	18	19	1020	1080	1140
			20	21	22	1200	1260	1320
			23	24	25	1380	1440	1500
			26	27	28	1560	1620	1680
			29	30	31	1740	1800	1860
			32	33	34	1920	1980	2040
			35	36	37	2100	2160	2220
			38	39	40	2280	2340	2400
			41	42	43	2460	2520	2580
			44	45	46	2640	2700	2760
			47	49	49	2820	2880	2940
			50	51	52	3000	3060	3120
			53	54	55	3180	3240	3300
			56	57	58	3360	3420	3480
			59	60	61	3540	3600	3660
			62	63	64	3720	3780	3840
			65	66	67	3900	3960	4020
			68	66	70	4080	4140	4200
			71	72	73	4260	4320	4380
			74	75	76	4440	4500	4560
			77	78	79	4620	4680	4740
			80	81	82	4800	4860	4920
			83	84	85	4980	5040	5100
			86	87	88	5160	5220	5280
			89	90	91	5340	5400	5460
			92	93	94	5520	5580	5640
			95	96	97	5700	5760	5820
			98	99	100	5880	5940	6000
			101	102	103	6060	6120	6180

How many drams in 1000, 500, 250, 125, $62\frac{1}{2}$, and $31\frac{1}{4}$ lbs?

N. B. Double 16 four times, which is the same as multiplied by 16 for drams, or by $2 \times 2 \times 2 \times 2 = 16$, thus twice $16 = 32$, twice $32 = 64$, &c.

16 oz. in 1 lb.
32
64
128
256 drams in 1 lb.
1000

256000 do. in 1000 lbs.

halve	128000	do. in	500 do.
	64000	do. in	250 do.
	32000	do. in	125 do.
	16000	do. in	$62\frac{1}{2}$ do.
	8000	do. in	$31\frac{1}{4}$ do.
	248000		$1968\frac{3}{4}$

How many pounds in 1000, 500, 256, 125, $62\frac{1}{2}$, and $31\frac{1}{4}$ cwts.?

112 lbs. in 1 cwt.
1000

halve	112000	do. in	1000 cwts.
	56000	do. in	500 do.
	28000	do. in	250 do.
	14000	do. in	125 do.
	7000	do. in	$62\frac{1}{2}$ do.
	3500	do. in	$31\frac{1}{4}$ do.
	220500	do. in	$1968\frac{3}{4}$ do.

How many pounds in 100, 50, 25, 12½, and 6¼ cwts. ?

112
100

			cwts.	qrs.	lbs.
halve	11200 lbs.	in	100	0	0
	5600 do.	in	50	0	0
	2800 do.	in	25	0	0
	1400 do.	in	12	2	0
	700 do.	in	6	1	0
	350 do.	in	3	0	14
	42050 do.	in	196	3	14

How many pounds in 10, 5, 2½, and 1¼ cwts. ?

112
10

			cwts.	qrs.	lbs.
halve	1120 lbs.	in	10	0	0
	560 do.	in	5	0	0
	280 do.	in	2	2	0
	140 do.	in	1	1	0
	70 do.	in	0	2	14
	2170 do.	in	19	1	14

How many ounces in 25 tons, and how much would 250 tons of snuff cost, at 3d. per ounce ?

25 tons
20 cwt. one to n
500
112
56000
4 × 4 = 16 oz. 1 lb.
224000
4
896000 = { 56000 doubled four times.

oz. in 25 tons 3d. is 1-80th. of 1/. { 1 / 80

£11200 = cost of 25 tons.
10
£112000 = cost of 250 tons.

Bought 4 hogsheads of sugar, each 4 cwt. 2 qrs. at 51s. per cwt. how much do they come to?

cwt.	qrs.
4	2
	4
18	0 in the whole.

The money may be divided into 2*l.* half a £. and 1s.

			£.	s.
18	× 2	=	36	0
18	½£.	=	9	0
18	× 1	=	0	18
			£45	18

What do 3 cwts. of tobacco come to, at 2s. 9d. per lb.?

112 × 3 = 336 lbs.
336 halfcrowns = 42 0
336 × 3 = 1008d. = 4 4

£46 4 the amount.

CLOTH MEASURE.

If 3¾ yards of cloth are required for one suit of clothes, how many yards would be required for a regiment of 1200 men?

	yards.
	3600 three times 1200
halve	600 half
	300 quarter
	4500

Three times 1200 will do for the yards, and 600 will do for the half yard, and 300 for the quarter of a yard, in figures as above.

What would be the expence of the same at 6s. 1d. per yard?

20)4500 yards

225	price at one shilling.
6	
1350	ditto at six shillings.
18	15
£1368	15

And supposing $1\frac{3}{4}$ yards of serge are required for lining each suit, how much would it come to at 1s. 1d. per yard?

1200	yards
600	half
300	quarter
20)2100	
105	
8	15
£113	15

2100 shillings are 105 pounds, and 2000 pence are 8*l.* 6s. 8d. to which add 8s. 4d. for the hundred pence and we obtain 113*l.* 15s. for all.

On Tuesday last I attended the coloured cloth-hall at Leeds, and seeing a person who had a sample of cloth likely to suit me, I enquired how many pieces he had of it, and he said three. I then asked him the length of each piece, and he said 40 yards each. The next question was, what would he take per yard; he then said 18s.; I said I would give 17s. 6d.; to which he

answered I cannot take it, but if you will give one penny per yard more you shall have it. Pray what had I to pay?

40 yards
3 pieces

120 yards in the whole

Seventeen shillings and seven-pence may be divided into half-a-pound, a crown, half-a-crown, and a penny.

120 half-pounds are 60 whole ones.
120 crowns are 30 0
120 half-crowns are 15 0
120 pence are 0 10

£105 10

N.B. This may be more briefly done by subtraction.

After coming out of the cloth-hall, I purchased 60 yards of cotton to line the same with; I gave 5d. per yard, what did the cotton stand me to?

60 yards, at a 1d. per yard, would cost 5s. and this being multiplied by 5, you obtain 25s. for the amount of the cotton.

LONG MEASURE.

How many inches in 1000, 500, 250, 125, $62\frac{1}{2}$, and $31\frac{1}{4}$ yards?

36 inches in 1 yard.
1000

36000 do. in 1000 do.
halve 18000 do. in 500 do.
9000 do. in 250 do.
4500 do. in 125 do.
2250 do. in $62\frac{1}{2}$ do.
1125 do. in $31\frac{1}{4}$ do.

From the above data, required the inches in 1 mile.

36
1000

halve	36000	inches	in 1000	yards.
	18000	do.	in 500	do.
	9000	do.	in 250	do.
	360	do.	in 10	do.
	63360	do.	in 1760	do. or 1 mile.

How many barleycorns in 1000, 500, 250, 125, $62\frac{1}{2}$; and $31\frac{1}{4}$ miles?

36 inches in 1 yard
3

108 barleycorns in do.

$108 \times 1760 = 190080$ barleycorns in 1 mile.
1000

halve	190080000	do.	in 1000	do.
	95040000	do.	in 500	do.
	47520000	do.	in 250	do.
	23760000	do.	in 125	do.
	11880000	do.	in $62\frac{1}{2}$	do.
	5940000	do.	in $31\frac{1}{4}$	do.
	274220000	do.	in $1968\frac{3}{4}$	do.

How many barleycorns would reach round the world, supposing it exactly 25000 miles in circumference?

190080 barleycorns in 1 mile
100000

halve	19008000000	do.	in 100000	do.
	9504000000	do.	in 50000	do.
	4752000000	do.	in 25000	do.—Ans.

If a coach wheel be 16 feet in circumference, how many times will it turn round between John O'Grott's house and the Lands End, which is a distance of 600 miles?

1760 yards in 1 mile.
3

$2\times2\times2\times2=16$ ——

halve 5280
2640
1320
660
330 times round per mile
600

198000 Ans.

Supposing a man to step 2 feet every pace, how many steps would he take from London to Harrogate and back again, a distance of 200 miles each way?

2)5280 feet per mile
2640 steps per do.
400

1056000 steps per 400 miles.—Ans.

If a wheel go round sixteen times in 1 minute, how many times would it go round in 24 hours, at the same rate?

16
60

960 times round per hour
100

halve 96000 do. per 100 do.
48000 do. per 50 do.
24000 do. per 25 do.
960 do. per 1 do.—subtract

23040 do. per 24 do.—Ans.

If a boat sail $6\frac{1}{2}$ miles per hour, how many would it sail in 2 years?

24		365	
$6\frac{1}{2}$		2	
144		730	days per 2 years
12		100	
156	miles per day	73000	miles per 100 days
		36000	do. per 50 do.
		4380	do. per 6 do.
		116880	do. in 2 years.—Ans.

If a pigeon fly 40 miles per hour, how many miles would it fly in 51 days of 12 hours long?

12	
40	
480	miles in 1 day of 12 hours long
100	
48000	do. in 100 do.
24000	do. in 50 do.
480	do. in 1 do.—add.
24480	—Ans.

WINE MEASURE.

How many pints are there in 1000 tuns of wine, and what would they cost at the three following prices, viz. 2s. 6d. 5s. and 7s. 6d. per pint.

63 gals. per hhd.
8

double 504 pints per do.
2

1008 do. in 1 pipe or but.
2

2016 do. in a tun.
2016 per tun of wine
1000

halfcrowns per 1*l.* 8)2616000 do. per 1000 tuns
double 252000 price per 2s. 6d. pint
504000 per 5s. per do.
756000 per 7s. 6d. per do.

Bought 100 dozen of wine of the vintage of 1811, and gave 55s. per dozen, what had I to pay for auction duty at the rate of one shilling in the pound ?

The money may be divided into 2 pounds, and 10s. and 5s.

100	100 half pounds are	50 whole ones
2	100 crowns are	25 do.
£200		75
		200
		£275 the whole amount of the wine.

consequently I have as many shillings duty to pay, viz. 275s. or 13*l.* 15s.

My friend and I agree to purchase the remaining stock of Cogniac brandy, belonging to a gentleman lately deceased. It consisted of 6 casks ; where he paid

one pound 1 paid two—the gross sum paid amounted to £210. what did each of us pay, and what was the price of each cask?

3)210

70 what the 1*l.* man paid
2

140 what the 2*l.* man paid
70

6)210 proof.

£35 per cask

It is obvious if I divide the whole gross sum by 3, I shall obtain what the first man paid, and if I double this sum, I obtain what the second paid, and it must be equally evident that if I divide the whole sum by the number of casks, I shall obtain the price per cask.

DRY MEASURE.

How many pints in 100000 lasts of corn?

N. B. 8 pints per 1 gal.

2

16 pints in 1 peck
4

64 pints in 1 bushel
8

512 pints in 1 qr.
10

5120 pints in 1 last

pints in 1 last.
5120
100000

Ans. 512000000

How many pints in 50000, 10000, and 1000 lasts?

2)512000000 pints in 100000 lasts
5)256000000 do. in 50000 do.
10) 51200000 do. in 10000 do.
5120000 do. in 1000 do.

Bought 80 lasts of wheat at 58s. per quarter, what have I to pay for the whole?

In a last there are ten quarters, therefore 80 × 10 make 800 Ans.

Perform this operation by subtraction, and call 58s. three pounds, then 800 × 3 make 2400*l.* from which take 800 shillings doubled. 800 shillings are equal to 40*l.* and this doubled, gives 80. Subtract 80 from 2400 and for the real amount, we obtain 2320*l.* the whole amount; or otherwise, by addition. Divide the money into 2*l.* half a pound, and a crown, and sixpence.

800 × 2 = £1600
800 $\frac{1}{2}$ pounds = 400
800 crowns = 200
800 $\frac{1}{2}$ crowns = 100
800 sixpences = 20

2320

What would 3000 quarters of barley come to at 29s. per quarter?

By Subtraction thus—

Call 29s. a pound and a half pound, then the amount will be £3000. and 3000 half pounds.

1500

4500

from this sum take 3000 shillings. Now 1000 shillings make 50*l.* according to the table, therefore three times 50 make 150*l.* which sum is to be taken from 4500*l.* and we obtain 4350*l.* for the real amount.

What would 1200 quarters of Friesland oats come to at 29s. 11d. per quarter?

In this operation, call 29s. 11d. a pound and half a pound, and calculate accordingly, afterwards deduct 12000 pence.

£.
12000

and 12000 $\frac{1}{2}$ pounds are = 6000 these two being added make 18000*l.* from which take 12000d. The table says that 12000d. make 50*l.* then subtract 50 from 18000 and we obtain 17950*l.* for the amount of the whole.

TIME.

How many minutes and seconds in a 1000, 500, 250, 125, 62$\frac{1}{2}$, 31$\frac{1}{4}$ years?

1440 min. per day
10

2) 14400 do. in 10 do.
7200 do. in 5 do.

21600 do. in 15 do.

24 hours in 1 day
60

1440 minutes in 1 day
25

36000 do. in 25 do.
2

72000 do. in 50 do.
7

504000 do. in 350 do.
21600 do. in 15 do.

525600 do. in 365 do.
1000

halve 525600000 do. in 1000 years
262800000 do. in 500 do.
131400000 do. in 250 do.
65700000 do. in 125 do.
32850000 do. in 62$\frac{1}{2}$ do.
16425000 do. in 31$\frac{1}{4}$ do.

For seconds.—Multiply by 100, and take half, to which add for 10, for the Ans.

525600000 min. in 1000 years
100

halve 52560000000 sec. 100 to the hour
add { 26280000000 do. 50 to the min.
{ 5256000000 do. 10 do.
31536000000 do. 60 do.

otherwise,

525600000 min. in 1000 years
add the cipher in 60 5256000000
double for 2 10512000000 } add
double for 4 21024000000 }
31536000000 same as above.
halve, and have all the Ans.

How many minutes in 100 years, &c.?

525600 min. in 1 year
100

halve 52560000 do. in 100 do.
26280000 do. in 50 do.
13140000 do. in 25 do.
6570000 do. in $12\frac{1}{2}$ do.
3285000 do. in $6\frac{1}{4}$ do.

How many minutes in 10 years, &c.?

525600 min. in 1 year
10

5256000 do. in 10 do.
2628000 do. in 5 do.
1314000 do. in $2\frac{1}{2}$ do.
657000 do. in $1\frac{1}{4}$ do.

How many minutes did my two children live, the first died when 6 months old, the second when $2\frac{1}{2}$ years old?

	halve	525600	min. in	1 year
age of the 1st.		262800	do. in	6 months
		525600	min. in	1 year
		10		
	halve	5256000	do. in	10 do.
		2628000	do. in	5 do.
age of the 2nd.		1314000	do. in	$2\frac{1}{2}$ do.

How many minutes did John Parr live, who died at the age of 152 years?

		525600	min. in	1 year
		100		
		52560000	do. in	100 do.
add		26280000	do. in	50 do.
		1051200	do. in	2 do.
		79891200	Parr's age in minutes.	

How many minutes in the age of Methuselah, who lived 969 years, and then died?

		525600	min. in	1 year
		1000		
		525600000	do. in	1000 do.
		13140000	do. in	25 do.
		2628000	do. in	5 do.
		525600	do. in	1 do.
subtract		16293600	do. in	31 do.
		509306400	Methuselah's age in minutes.	

If I live until I be 75 years old, how many minutes shall I have lived ?

525600 min. in 1 year
100

52560000 do. in 100 do.
add { 26280000 do. in 50 do.
13140000 do. in 25 do.
39420000 do. in 75 do.—Ans.

How many minutes have those gentlemen lived whose ages are 35 and 75 years, respectively ?

525600 min. in 1 year
100

52560000 do. in 100 do.
add { 26280000 do. in 50 do.
13140000 do. in 25 do.
39420000 75 yrs. old.—Ans.

525600 min. in 1 year
100

52560000 do. in 100 do.
26280000 do. in 50 do.
add { 13140000 do. in 25 do.
5256000 do. in 10 do.
18396000 35 yrs. old.—Ans.

I have two friends whose united ages amount to $42\frac{1}{2}$ years, how many minutes has he lived whose age is double theirs ?

525600 min. in 1 year
100

52560000 do. in 100 do.
add { 26280000 do. in 50 do.
13140000 do. in 25 do.
5256000 do. in 10 do.
44676000 do. in 85 do.—Ans.

SQUARING OF NUMBERS.

What is the square of 5?

5

—

25

What is the square of 25?

This is somewhat harder than the last. The common way is to multiply 25 by 25, but in order to accomplish this easily, I beg to give you the following Rule.

Add the lower unit to the upper number, and multiply the sum by the remainder, to which product add the square of the unit, and you easily obtain the answer,—thus

25

25

—

30

20

—

600

25 = 5^2

—

625

What is the square of 125?

125

—

150

100

—

15000

625 = 25^2

—

15625

What is the square of 36, 89, and 99?

36	89	99
36	89	99
42	98	108
30	80	90
1260	7840	9720
36	81	81
1296	7921	9801

What is the square of 112, 630, 960?

112	630	960
112	630	960
124	660	1020
100	600	900
12400	396000	918000
144	900	3600
12544	396900	921600

What is the square of 75?

75
75
80
70
5600
25
5625

What would the flagging of a square building come to, one side of which measures 75 yards, at 2s. per yd.?

75
75
—
80
70
—
5600
25
—
5625
2
—
11250 = £562. 10s.—Ans.

What would the mason-work come to, of a square building, one side of which measures 30 yards, at 5s. per yard?

30
30
—
900
4
—
halve 3600 crowns
1800 half £.
£900.—Ans.

What is the square of 652?

652	52
652	52
—	—
704	104
600	260
—	—
422400	2704
2704	
—	
425104	

What would the flagging of a square building come to, one side of which measures 56 yds, at 2s. 6d. per yd.?

56
56
—
62
50
—
3100
36
—
3136 halfcrowns
1568 crowns
784 half £.
Ans.—£392. the amount.

In my house are 16 square sash lights, one side of each of which contains 4 squares, of a 1 foot each, how much would the glazing come to, at 2s. 6d. per foot?

16
16
—
256 halfcrowns
128 crowns
64 half £.
Ans.—£32. the amount.

Square the following numbers.

			Products		
125	150	175	15625	22500	30625
225	250	275	50625	62500	75625
325	350	375	105625	122500	140625
425	450	475	180625	202500	225625
525	550	575	275625	302500	330625
625	650	675	390625	422500	455625
725	750	775	525625	562500	600625
825	850	875	680625	722500	765625
925	950	975	855625	902500	950625
1025	1050	1075	1050625	1002500	1155625
1125	1150	1175	1265625	1322500	1380625
1225	1250	1275	1500625	1562500	1625625

In the first column take away the 25 above and below, and multiply the remaining figures, minding the proper count of ciphers. In the first example it is 1×1 and 4 ciphers. In the second it is 2×2 and 4 ciphers. In the third it is 3×3, &c. To this product in the first example, add 5000 and the square of 25, which is always 625. In the second add 10000 and 25^2; and in the third, add 15000 and 25^2.

Square 825.

800	the 25 taken away it is simply
800	8×8, and four ciphers.
640000	
40000	half of the first figure always
625	$= 25$ squared
680625	

In the second column take away 50, and square the remainder to this product, which is precisely the same as the last column; add in the first example 10000, in

the second, 20000, in the third, 30000, &c. besides the square of 50, which is nothing more than 5 × 5 and 2 ciphers.

Square 650.

600
600

360000
60000
2500

422500

In the third column unite both the preceding, thus $275^2 = 40000 + 20000$ and 10000, and the square of $75 = 5625 = 75625$ in the whole.

MONEY.

How many pence in 2*l.*?	480
How many do. in 5 do.	1200
How many do. in 8 do.	1920
How many do. in 12 do.	2880
How many do. in 15 do.	3600
How many farthings in 60 do.	57600
How many do. in 85 do.	81600
How many do. in 100 do.	96000
How many crowns in 500 do.	2000
How many do. in 60 do.	240
How many do. in 36 do.	144
How many do. in 90 do.	360
How many halfcrowns in 10 do.	80
How many do. in 80 do.	640
How many shillings in 20 do.	400

How many half-sovereigns in 124 crowns	62
How many do. in 96 do.	48
How many do. in 1000 do.	500
How many do. in 600 do.	300
How many farthings in 25*l.*	24000
How many do. in 500 do.	480000
How many do. in 5000 do.	4800000
How many do. in 250 do.	240000
How many do. in 125 do.	120000
How many minutes in 5 hours	300
How many do. in 15 do.	900
How many do. in 25 do.	1500
How many do. in 50 do.	3000
How many do. in 75 do.	4500
How many do. in 500 do.	30000
How many inches in 5 feet	60
How many do. in 15 do.	180
How many do. in 25 do.	300
How many do. in 35 do.	420
How many do. in 50 do.	600
How many do. in 75 do.	900
How many do. in 500 do.	6000
How many do. in 750 do.	9000

How many farthings in 10*l.*, 5*l.*, 2*l.* 10s., 1*l.* 5s., and 12s. 6d.?

960 farthings in 1*l.*
10

halve	9600	do. in 10*l.*
	4800	do. in 5*l.*
	2400	do. in 50s.
	1200	do. in 25s.
	600	do. in 12s. 6d.

How many farthings in 100*l*., 50*l*., 25*l*., $12\frac{1}{2}$*l*. and $6\frac{1}{4}$*l*. ?

960
100

halve	96000	farthings	in	100*l*.
	48000	do.	in	50*l*.
	24000	do.	in	25*l*.
	12000	do.	in	$12\frac{1}{2}$*l*.
	6000	do.	in	$6\frac{1}{4}$*l*.

How many farthings in 100000*l*., 50000*l*., 25000*l*., 12500*l*., 6250*l*., 3125*l*., and $1562\frac{1}{2}$. ?

960
100000

halve	26000000	farthings	in	100000*l*.
	48000000	do.	in	50000*l*.
	24000000	do.	in	25000*l*.
	12000000	do.	in	12500*l*.
	6000000	do.	in	6250*l*.
	3000000	do.	in	3125*l*.
	1500000	do.	in	$1562\frac{1}{2}$*l*.

How many pence are there in 10000*l*., 5000*l*., 2500*l*., 1250*l*., 625*l*., $312\frac{1}{2}$*l*., and $156\frac{1}{4}$*l*. ?

240 pence in 1*l*.
10000

halve	2400000	pence	in	10000*l*.
	1200000	do.	in	5000*l*.
	600000	do.	in	2500*l*.
	300000	do.	in	1250*l*.
	150000	do.	in	625*l*.
	75000	do.	in	$312\frac{1}{2}$*l*.
	57500	do.	in	$156\frac{1}{4}$*l*.

How many pence in 1000*l.*, 100*l.*, and 10*l.* &c.

240d. in 1*l.* 1000	240d. in 1*l.* 100	240d. in 1*l.* 10
240000d. in 1000*l.*	24000d. in 100*l.*	2400d. in 10*l.*
120000d. in 500*l.*	12000d. in 50*l.*	2400d. in 5*l.*
60000d. in 250*l.*	6000d. in 25*l.*	600d. in 50s.
30000d. in 125*l.*	3000d. in $12\frac{1}{2}$*l.*	300d. in 25s.
15000d. in $62\frac{1}{2}$*l.*	1500d. in $6\frac{1}{4}$*l.*	150d. in $12\frac{1}{2}$s.
7500d. in $31\frac{1}{4}$*l.*	750d. in 3*l.* 2s 6d.	75d. in $6\frac{1}{4}$s.

How many farthings in the National Debt of England, which is 800000000*l.*

960 farthings in 1*l.*
100000001

96000000000 farthings in 100000000*l.*
192
384
768000000000—Ans.

In this example, if we multiply the farthings in one pound by one hundred millions, it is plain we shall obtain the farthings in one hundred millions of pounds, double the sum and we obtain the farthings in two hundred millions, double again and we obtain the farthings in four hundred millions, and lastly, double it again, and we obtain the number of farthings in the National Debt, taking it at eight hundred millions of pounds.

N. B. The doubling of 96 three times need not be encumbered with ciphers every time ; perform it without, and affix the ciphers to the last operation, for the answer.

BILLS OF PARCELS.

In calculating these bills the coins of the realm are generally used;—pounds, half-pounds, crowns, half-crowns, shillings, sixpences, &c. &c. They are what every one is best acquainted with, and what people in general calculate by. Halving and doubling are what every one may easily understand; by these, and an intimate acquaintance with the tables, a person may soon become an expeditious and safe Mental Calculator.

TABLE.

s.	d.		s.	d.
1	3	is the one-half of	2	6
0	7½	is the one-half of	1	3
0	3¾	is the one-half of	0	7½
0	3	is the one-half of	0	6
0	1½	is the one-half of	0	3

The following Bills are calculated by the coins of England, and the above table.

Bingley, Feb. 23d, 1826.

Mr. Samuel Catton,

1825. *Bought of Edward Whitley,*

	£.	s.	d.	£.	s.	d.
July						
16. 1 leg of mutton, 12lbs. at 7½d. p. lb.	0	7	6			
23. 1 sirloin of beef, 24lbs. at 8d. p. lb.	0	16	0			
28. 1 inlift of beef, 44lbs. at 6½d. p. lb.	1	3	10			
				2	7	4
Aug.						
2. 1 loin of veal, 9lbs. at 8⅓d. per lb.	0	6	4⅓			
3. 1 fillet of do. 7lbs. at 6⅓d. per lb.	0	3	9⅓			
6. 1 shoulder of do. 6lbs. at 5d. p. lb.	0	2	6			
20. To cutlets (veal) 2lbs.	0	1	3			
29. 1 calf's head	0	1	3			
				0	15	2
Sep.						
7. 1 round of beef, 48lbs. at 6½d. p. lb.	1	6	0			
16. 1 leg of pork, 18lbs. at 8d. p. lb.	0	12	0			
23. 1 breast of veal, 6½lbs. at 4d. p. lb.	0	2	2			
				2	0	2
Oct.						
3. 1 crop of beef, 36lbs. at 9d. p. lb.	1	7	0			
14. 1lb. of beef steaks	0	0	8			
26. 1 haunch of venison, 14lbs. at 10d. per lb.	0	11	8			
				1	19	4
Nov.						
5. 1 neck of mutton, 5lbs. at 4d. p. lb.	0	1	8			
15. 1 suckling pig	0	7	6			
				0	9	2
Dec.						
8. 1 stew	0	2	6			
12. 1 beast's heart	0	1	6			
20. 1 inlift & 1 crop, 70lbs. at 8d. p. lb.	2	6	8			
				2	10	8
				£10	1	10

This form of bill making is a desideratum and highly to be recommended generally.

Article 1. 12 lb. at 1d. per lb. would be a shilling, therefore 12 lb. at $7\frac{1}{2}$d. will be 7s. and a half, or 7s. 6d.

2. 24 sixpences are 12s. and 24 twopences are 48d. or 4s. 12s. + 4s. = 16s. the amount.

3. 44 sixpences are 22s. and 44 halfpennies are 22d. or 1s. 10d. which being added make 23s. 10d. or 1*l*. 3s. 10d. This being the last article obtained this month, the monthly account is added up and kept separate.

Second month.—Article 1. By multiplication $9 \times 8 = 72$d. or 6s. and nine halfpennies are $4\frac{1}{2}$d. being added make 6s. $4\frac{1}{2}$d. and the remainder of the articles in this month, may be calculated in the same way.

Third month.—Article 1. 48 sixpences are 24s. and 48 halfpennies are 24d. or 2s. making 1*l*. 6s. together.

2. 18 sixpences are 9s. and 18d. doubled are 3s. making together 12s.

3. $6\frac{1}{2}$lb. at 4d. are equal to 4lb. at $6\frac{1}{2}$d. making 2s. 2d.

Fourth month.—Article 1. 36 lb. at 1d. would be 3s. therefore nine times three will be the amount.

3. 14 lb. at 10d. by multiplication are 140d. and by the pence table make 11s. 8d.

Last month.—Last article. 70 lb. at 1d. would be 5s. 10d. therefore $8 \times 5 = 40$s. and 80d. or 6s. 8d. making 2*l*. 6s. 8d. This bill is exhibited more for the form of it, than the calculation.

Manchester, Nov. 17th, 1828.

Mr. Smithson,

Bought of John Towns.

		£.	s.	d.
24	yards of calico, at 3½d. per yard	0	7	0
32	do. of do. at 4d. per do.....	0	10	8
36	do. of do. at 5½d. per do.....	0	16	6
44	do. of do. at 6d. per do.	1	2	0
48	do. of do. at 7½d. per do.....	1	10	0
60	do. of do. at 8d. per do.	2	0	0
64	do. of do. at 9½d. per do.....	2	10	8
72	do. of do. at 10d. per do.....	3	0	0
80	do. of do. at 11½d. per do.	3	16	8
84	do. of do. at 1s. 1½d per do.	4	14	6
96	do. of do. at 1s. 2d. per do.....	5	12	0
108	do. of do. at 1s. 3½d. per do.	6	19	6
120	do. of do. at 1s. 4d. per do.....	8	0	0
144	do. of do. at 1s. 5d. per do.....	10	4	0
160	do. of do. at 1s. 6d. per do.....	12	0	0
240	do. of do. at 1s. 10d. per do.	22	0	0
320	do. of do. at 1s. 11d. per do.	30	13	4
360	do. of do. at 2s. per do.....	36	0	0
		£150	12	10

Article 1. 24 threepences are 6s. and 24 halfpennies are 1s. making together 7s.

2. 32 threepences are 16 sixpences, or 8s. and 32d. are 2s. 8d. making together 10s. 8d.

3. By subtraction 36 sixpences are 18s. from which take 36 halfpennies or 1s. 6d. and 6s. 6d. remain.

4. 44 sixpences are 22s. or 1*l.* 2s.

5. 48 at 1d. would be 4s. therefore 7 times 4 = 28s. to which add 48 halfpennies or 2s. making 1*l.* 10s.

6. 60 at a penny would be 5s. therefore 5 × 8 = 40s. or 2*l.*

7.

		s.	d.
64	sixpences are	32	0
64	threepences are	16	0
64	halfpennies are	2	8
		50	8

8. 72 at 1d. would amount to 6s. therefore when multiplied by 10 we obtain 60s. or 3*l.*

9. 80s. would be 4*l.* from which take 80 halfpennies or 40d. or 3s. 4d. leaving 3*l.* 16s. 8d.

10.

		£.	s.	d.
84	shillings are	4	4	0
84	pence are	0	7	0
84	halfpence are	0	3	6
		4	14	6

11.

		£.	s.	d.
96	shillings are	4	16	0
96	pence doubled	0	16	0
		5	12	0

Maidstone, Kent, Feb. 15th, 1827.

Mr. Seamore,

Bought of James Creswell.

1826:		£.	s.	d.
Oct.				
6.	To 10 reams of foolscap, at 15d. per qr.	12	10	0
9.	16 do. at 13d. per do.	17	6	8
12.	20 do. at 11d. per do.	18	6	8
16.	24 do. of fine pot, at 10d. per do. ..	20	0	0
23.	32 do. of common do. at 9d. per do.	24	0	0
27.	36 do. of inferior do. at 7½d. per do.	22	10	0
Nov.				
1.	400 do. larger newspaper size, at 2s. 6d. per do.....1000	0	0	
5.	200 do. small do. at 2s. 3d. per do..	450	0	0
	240 do. of cartridge paper, at 8d. p. do.	160	0	0
	320 do. of cap paper at 6½d. per do.	160	0	0
15.	112 do. of do. at 6½d. per do.....	60	13	4
20.	84 superfine imperial sheets, at 2s. 5d. each.....	10	3	0
	120 superfine drawing sheets, at 8½d. do.	4	5	0
30.	60 common do. small size, at 4d....	1	0	0
	1000 reams of bath letter paper, gilt edged, demy wove, at 1s. 6d. p. qr.	1500	0	0
		£3460	14	8

In calculating the first item we must recollect that 20 quires make a ream, therefore 20 threepences are a crown, to which add 20 shillings and we obtain one pound five shillings per ream. Ten times one pound five are twelve pounds ten shillings.

In calculating the second we shall find that 1*l.* 1s. 8d. is the price per ream, and therefore 16 times a pound, 16 times a shilling, and 16 times 8d. will make the sum 17*l.* 6s. 8d. as required.

Let us calculate the third item by subtraction. The price per ream will be found to be 20s. calling 11d. a shilling, from which take twenty pence and we obtain 18s. 4d. per ream. Again calling 18s. 4d. a pound, the price will be 20*l.* from which we must take 20 times 1s. 8d. or 20s. 20 sixpences and 20 twopences, or 1*l.* 13s. 4d. and we shall obtain 18*l.* 6s. 8d. for the whole price.—Sometimes it is more convenient to use subtraction, sometimes addition, but I advise both ways for practice.

In calculating the fourth article, 20 quires at 10d. will give 200d. = 16s. 8d. per ream. Now this money may be divided into half a pound, a crown, and 1s. 8d. 24 half pounds are 12*l.* and half as much for the crowns make 18*l.* to which add 24s. and 24 sixpences = 36s. and 24 twopences = 48d. = 4s. therefore 36 and 4 make forty. 40s. are 2*l.* which being added to 18*l.* make 20*l.* the amount of the whole.

Another way by pence table, 24 × 20 make 480, to which add a cipher for the 10 and we obtain 4800d. which by inspecting or recollecting pence table we see make 20*l.*

Article 5. 20 halfcrowns are 50s. therefore twice 400 are 800*l.* and 400 half pounds are 200 whole pounds which being added make 1000*l.* in the whole.

Bingley, March 2nd, 1826.

Mr. Bateman,

Bought of James Nursaw.

	£.	s.	d.
10000 quicks, at 5d. per 100	2	1	8
300 poplars, at 4d. each	50	0	0
600 larch trees, at 8d. per score.....	1	0	0
250 birch do. at 9d. a score.....	9	7	6
120 young apple do. at 1s. 4d. each	8	0	0
84 pear do. at 1s. 6d. do.	6	6	0
72 cherry do. (may dukes) at 1s. 8d....	6	0	0
720 berry do. at 4d. do.	12	0	0
900 oak plants, at 1⅓ . each	5	12	6
760 scotch firs, at 2d. do.....	6	6	8
540 ash tree plants, at 2d. do.....	4	10	0
24 spruce firs, at 7d. do.....	0	14	0
48 sycamore plants, at 10d. do.....	2	0	0
20 mountain ash do. at 9d. do.....	0	15	0
36 nectarine do. at 3s. 6d. do.	6	6	0
36 peach do. at 3s. do.	5	8	0
30 apricot do. at 2s. 3d. do.	3	7	6
54 magnum bonum do. at 4s. do.	10	16	0
70 common yellow plums, at 9d. do.....	2	12	6
	£143	3	4

Nottingham, Jan. 26th, 1827.

Mr. Williamson,

Bought of Samuel Smith.

	£.	s.	d.
60 oz. of stocking yarn, at 3d. per oz..	0	15	0
36 doz. of women's hose, at 1s. per pair	21	12	0
16 do. of women's silk do. at 7s. 6d. p. do.	72	0	0
48 do. of children's do. at 3s. 6d. per do.	100	16	0
60 do. of men's lamb wool, at 3s. per do.	108	0	0
72 do. of men's black silk hose, at 11s. per do.....	475	4	0
84 yards of net lace, at 15s. per yard..	63	0	0
80 doz. of men's superfine waterproof hats, at 17s. 6d. each.....	70	0	0
96 leghorn bonnets, at 35s. do.	168	0	0
100 children's do. at 25s. do.....	125	0	0
240 tortoise-shell combs, at 4s. 6d. do...	54	0	0
1000 yards of pink ribbon, at 1½d. p. yard	6	5	0
10000 do. of white do. at 1½d. per do.	62	10	0
12000 do. of blue do. at 2d. per do.	100	0	0
16000 do. of black do. at 2½d. per do.....	166	13	4
20000 do. of green do. at 3d. per do.....	250	0	0
24000 do. of scarlet do. at 4d. per do.....	400	0	0
	£2243	15	4

Bought print at the rate of 1s. per yard, how many yards could I have for 20s. ? Ans. 20 yards.

I think I hear you call this bagatelle.

Bought flour at the rate of 2s. per stone, how many stones could I have for 5*l.* ?

In 5*l.* there are 100s. and therefore this number divided by 2 will give the number of stones. Ans. 50.

Bought beef at the rate of 2s. 6d. per stone, how many stones had I for 12*l.* ?

In one pound there are eight halfcrowns, therefore as many halfcrowns as there are in 12*l.* I shall receive so many stones. Ans. $12 \times 8 = 96$.

Bought cloth at the rate of 5s. per yard, how many yards had I for 125*l.* ?

As in this question I get 4 yards for every pound ; four times the number of pounds will be the answer, viz. $125 \times 4 = 500$ yards.

But before we proceed to higher denominations let us review the ground we have already passed over and see if there be any other easier method than what we have already followed.

Gave after the rate of 2s. 6d. per yard, and expended 225*l.* how many yards had I for this sum ?

In this sum it is evident that I received as many yards as there are halfcrowns in 225*l.* but it may not be so easy for all to multiply large sums by 8 as by 2. We will therefore try this sum by the doubling system.

double	225	pounds
	450	half pounds
	900	crowns
	1800	halfcrowns

Now as I am to have so many yards as there are halfcrowns in the sum, I shall receive 1800 yards. The same by multiplication.

225
8
1800

Work the following sum by doubling.

Gave 1s. 3d. per yard for print, and expended 800*l.* how many yards did I receive—and four years afterwards I expended the same sum, but got print in as good quality the latter purchase as the former for only 7½d. per yard; pray how many yards had I each purchase ?

	double 800	pounds	
	1600	half pounds	
	3200	crowns	
	6400	halfcrowns	
therefore so many yards	12800	the former purchase	
therefore so many yards	25600	the latter purchase	

N. B. 1s. 3d. is the ½ of half a crown and 7½d. is the ½ of 1s. 3d. and supposing I had expended the same sum on an inferior quality at 3¾d. per yard it would be doubling again for the number of yards.

Gave after the rate of 7s. 6d. per yard, and expended 1250*l.* how many yards ought I to have?

Reduce this sum into halfcrowns by multiplying by 8, and then divide by 3, because 7s. 6d. are equal to 3 halfcrowns, therefore as many threes as there shall be, so many yards ought I to receive.

1250
8

3)10000

yards 3333—$\frac{1}{3}$ Ans.

Gave after the rate of 3s. 4d. per yard and expended 500*l.* how many yards ought I to have?

In one pound there are six times 3s. 4d. therefore for one pound I shall receive six yards, and for 500*l.* I ought to receive 500 × 6 viz. 3000 yards.

Gave 6s. 8d. per yard and expended 600*l.* how many yards ought I to have?

In one pound there are three times 6s. 8d.; therefore for one pound I shall receive three yards, and for 600*l.* I ought to receive 600 × 3, viz. 1800 yards.

If I give 10s. for one hat, how many ought I to receive for 12*l.*?

As 10s. is the half of a pound, I shall have two hats for 1*l.* and 24 hats for 12*l.*

If I give 12s. 6d. for one cheese, how many ought I to receive for 120*l.*?

In this case 12s. 6d. are equal to five halfcrowns, therefore reduce the money into halfcrowns, and for every five I shall receive a cheese; thus

120
8

5)960

192 cheeses I ought to receive.

If I give 15s. for 1 yard of black cloth, how many ought I to receive for 1200*l.* ?

1200*l.*
4

3)4800

1600 yards of cloth I ought to receive.

Gave after the rate of 17s. 6d. for a yard of superfine saxony blue cloth, and expended 2100*l.* how many yards ought I to receive?

17s. 6d. are equal to 7 halfcrowns, therefore 2100*l.* reduced into halfcrowns, and then divided by seven, we shall obtain the number of yards I ought to receive.

2100*l.*
8

7)16800

2400 the yards I ought to receive.

If I give 1s. 4d. for one pair of stockings, how many pairs ought I to receive for 48*l.*

In this case 1s. 4d. are equal to one-fifteenth part of a pound, therefore 48*l.* multiplied by 15*l.* will give the answer,—because for one pound I receive 15 pairs, thus $48 \times 15 = 720$ pairs.—Ans.

Multiply thus,

$$\begin{array}{rcl} 48 & & 48 \\ 10 & & 5 \\ \hline 480 & + & 240 = 720 \end{array}$$

AN ACCOUNT CURRENT

BETWEEN

John Smith, of Shipley, Dr. and William Rhodes, of Bradford, Cr.

Dr.	£.	s.	d.	*Cr.*	£.	s.	d.
June 20. To 1000lbs. of cotton, at $6\frac{1}{2}$d. per lb.....	27	1	8	June 30. By 64 yards of cloth, at 8s. per yard	25	12	0
July 9. To 112lbs. of cotton, at 6d. per do.	2	16	0	July 10. By 300 hams, at 25s. per ham	375	0	0
Aug. 16. To 20 qrs, of wheat, at 63s. per qr.	63	0	0	Aug. 9. By 250 cheeses, at 18s. per cheese.....	225	0	0
Sep. 18. To 12 tuns of logwood, at 6*l*. 15s. per cwt....	1620	0	0	Sep. 5. By 700 pair of hose, at 3s. per pair.....	105	0	0
Oct. 12. To 20 do. of camwood, at 24*l*. per do.	9600	0	0	Oct. 7. By a bill, value 20*l*.....	20	0	0
Nov. 20. To 30 cwt. of tallow, at 38s. per do.....	57	0	0	Nov. 6. By 50 yards of velveteen, at 3s. 3d. per yard .	8	2	6
Dec. 8. To 300 hats, at 16s. each	240	0	0	Dec. 31. By balance	10851	3	2
	£11609	17	8		£11609	17	8

1st Article on the debtor's side.

1000 sixpences are = 500s. or 25*l.* 1000 $\frac{1}{2}$d. are = 500d. or 2*l.* 1s. 8d. making in the whole 27*l.* 1s. 8d.

2d Article. 112 sixpences are = 56s. or 2*l.* 16s.

3d Article. 20 qrs. at 63s. is the same as 63 qrs. at 1*l.* therefore 63*l.*

4th Article. 12 tuns are equal to 240 cwt. 6 times 240 = 1440*l.* add to these 240 half pounds, and 60*l.* for the crowns, and we obtain 1620*l.*

5th Article. 20 × 20 = 400 cwts. which being multiplied by 24, make 9600*l.*

6th Article. Call 38s. 2*l.* then twice 30*l.* are 60*l.* from which take 60s. or 3*l.*

7th Article. 16 × 300 = 4800s. and by table are equal to 240*l.*

1st Article on the Creditor side.

8s. may be divided into a crown, halfcrown, and 6d.

	£.	s.
64 crowns = 32 half pounds =	16	0
64 halfcrowns =	8	0
64 sixpences = 32s. =	1	12
(or thus)	£25	12

64 × 8 = 512s. and by table equal to the same sum.

2d. Article. This article will be best calculated by pounds and crowns.

3d. Article. This may soon be done by subtraction. 500s. from 250*l.* leave 225*l.*

4th Article. By multiplication. 700 × 3 = 2100s. by table equal to 105*l.*

6th Article. By the same. 50 × 3 = 150s. and as many pence.

Bingley, Feb. 16, 1826.

Mr. Sugden,

To Thomas Drugman, Dr.

	£.	s.	d.
To 120 lb. of nut galls, at 3s. 9d. per lb.	22	10	0
12 do. of sulphate of iron, at 1d. per do.	0	1	0
50 do. of logwood, at 1½d. per do....	0	6	3
60 oz. of sulphate of copper, at 4d. p. do.	1	0	0
80 lb. of indigo, at 11s. per do.....	44	0	0
10 oz. of arrow root, at 10d. per oz....	0	8	4
50 bottles of gum elastic, at 4d. each..	0	16	8
100 sticks of indian ink, at 6d. each ..	2	10	0
200 reams of letter paper at, 11s. p. ream	110	0	0
8 do. of cap paper at 1s. 2d. per. quire	9	6	8
120 reams of foolscap, at 1s. 6d. p. quire	180	0	0
12 lb. of brown packing paper, at 8d. per lb.....	0	8	0
8 do. of gamboge, at 9d. per do.....	0	6	0
18 do. of gum arabic at 4s. per do....	3	12	0
60 do. of verdigris at 7d. per do.....	1	15	0
80 do. of macaroni, at 3s. 4d. per do..	13	6	8
	£390	5	7

Bradford, Nov. 13th, 1828.

Mr. Williams,

Bought of Samuel Sims.

		£.	s.	d.
2	pieces of stuffs, each 30 yards. at 7d. per yard, ...	1	15	0
4	pieces of stuffs, at 8d. per yard	4	0	0
6	do. do. at 10d. per do.....	7	10	0
8	do. do. at 11d. per do.....	11	0	0
10	do. do. at 1s. ½d. per do....	15	12	6
12	do. do. at 1s. 1d. per do....	19	10	0
14	do. do. at 1s. 2d. per do....	24	10	0
16	do. do. at 1s. 3d. per do....	30	0	0
18	do. do. at 1s. 4d. per do.....	36	0	0
20	do. do. at 1s. 5d. per do....	42	10	0
30	do. do. at 1s. 6d. per do....	67	10	0
40	do. do. at 1s. 7½d. per do....	97	10	0
50	do. do. at 1s. 9d. per do....	131	5	0
60	do. do. at 1s. 10d. per do....	165	0	0
100	do. do. at 1s. 11d. per do....	287	10	0
200	do. do. at 2s. per do....	600	0	0
400	do. do. at 2s. 3d. per do....	1350	0	0
800	do. do. at 2s. 6d. per do....	3000	0	0
		£5891	2	6

Burnley, Feb. 3d, 1829.

Mr. Samuel Corson,

Bought of Edward Whittaker.

	£.	s.	d.
50 yards of tape, at 0½d. per yard.....	0	2	1
36 do. of white ribbon, at 1½d. per do.....	0	4	6
12 do. of pink do. at 2d. per do.	0	2	0
16 do. of black do. at 3d. per do.....	0	4	0
24 do. of printed cotton, at 4d. per do.....	0	8	0
32 do. of do. at 4½d. per do.....	0	12	0
48 do. of do. at 5d. per do.....	1	0	0
72 do. of do. at 6d. per do.....	1	16	0
84 do. of do. at 7½d. per do.....	2	12	6
96 do. of do. at 8d. per do.....	3	4	0
120 do. of do. at 9d. per do.....	4	10	0
160 do. of do. at 10d. per do.....	6	13	4
240 do. of do. at 11d. per do.....	11	0	0
160 do. of do. at 1s. 1½d. per do.....	9	0	0
126 do. of do. at 1s. 3d. per do.....	7	17	6
320 do. of do. at 1s. 4½d. per do.....	22	0	0
480 do. of do. at 1s. 5d. per do.....	34	0	0
448 do. of do. at 1s. 6d. per do.....	33	12	0
	£138	17	11

SKELETON BILL,

To be properly formed and written out, by young boys.

	s.	d.	£.	s.	d.
124 yards of cloth, at	2	6	15	10	0
64	3	6	11	4	0
164	4	6	36	18	0
184	5	0	46	0	0
196	5	6	53	18	0
224	6	0	67	4	0
248	6	6	80	12	0
260	7	0	91	0	0
280	7	6	105	0	0
320	8	0	128	0	0
384	8	6	163	4	0
720	9	0	324	0	0
840	9	6	399	0	0
840	10	0	420	0	0
880	10	6	462	0	0
900	11	0	495	0	0
960	11	6	528	0	0
1200	12	0	720	0	0
2400	12	6	1500	0	0

To be added up £

ANOTHER SKELETON BILL.

	s.	d.	£.	s.	d.
20	2	0	2	0	0
24	2	3	2	14	0
30	2	6	3	15	0
32	2	9	4	8	0
36	2	10	5	2	0
40	3	0	6	0	0
48	3	6	8	8	0
50	4	0	10	0	0
56	5	0	14	0	0
60	5	6	16	10	0
64	6	0	19	4	0
70	7	6	26	5	0
72	8	0	28	16	0
80	9	0	36	0	0
84	10	0	42	0	0
96	12	6	60	0	0
100	15	0	75	0	0
120	17	6	105	0	0
124	18	6	114	14	0
136	19	0	129	4	0

To be added up £

Leeds, Dec. 19th, 1826.

Mr. Spearman,

Bought of William Smith.

	s.	d.		£.	s.	d.
16 yards of cloth at	1	6	per yard....	1	4	0
20 do.	2	0	per do.....	2	0	0
24 do.	2	3	per do.....	2	14	0
30 do.	2	6	per do.....	3	15	0
32 do.	2	9	per do.....	4	8	0
36 do.	2	10	per do.....	5	2	0
40 do.	3	0	per do.....	6	0	0
48 do.	3	6	per do.....	8	8	0
50 do.	4	0	per do.....	10	0	0
56 do.	5	0	per do.....	14	0	0
60 do.	6	0	per do.....	18	0	0
64 do.	7	6	per do.....	24	0	0
70 do.	8	0	per do.....	28	0	0
72 do.	9	0	per do.....	32	8	0
80 do.	10	0	per do.....	40	0	0
84 do.	12	6	per do.....	52	10	0
96 do.	15	0	per do.....	72	0	0
100 do.	17	6	per do.....	87	10	0
120 do.	18	6	per do.....	111	0	0
124 do.	19	0	per do.....	117	16	0
136 do.	19	6	per do.....	132	16	0

To be added up £

SQUARING DIMENSIONS.

Multiply ft.	in.	by	ft.	in.	Products ft.	in.
5	6	by	2	0	11	0
5	6		1	3	6	10
6	8		2	3	15	0
5	6		1	8	9	2
7	6		3	6	26	3
10	8		1	6	16	0
9	4		1	3	11	8
18	0		1	8	30	0
58	0		1	10	106	4
55	6		1	6	83	3
20	0		18	0	360	0

Multiply ft.	in.	by	ft.	in.	Products ft.	in.
20	0	by	9	6	190	0
20	8		18	8	385	9
15	10		1	6	23	9
155	0		2	3	348	9
23	4		20	4	474	5
22	8		19	8	445	9
52	9		27	4	1441	10
6	9		4	6	30	4
24	6		0	10	22	1
16	0		0	9	12	0
12	0		10	0	120	0

(1)	5	6			(2)	5	6			(3)	6	8				
	2	0				1	3				2	3				
	11	0				5	6				13	4				
						1	4	6			1	8	0			
						6	10	6			15	0	0			

Multiply crosswise, beginning always at the left, and divide every product but feet and feet, by 12, thus example third: twice 8 are 16, the twelves in 16 once and 4 over, put down 4 and carry 1.—Twice six are 12 and one I carry makes 13, put down 13. Three times 8 are 24, the twelves in 24 twice and nothing over, put down 0 a place more to the right than inches and carry two: three times 6 are 18 and 2 I carry make 20. Divide these 20 inches by 12 for feet, put down one under feet and 8 under inches, and add up for the content, and so on with every operation, as all are alike.

INTEREST.

Bankers discount bills at a penny a pound per month. This is at the rate of 5 per cent. Per cent means per hundred. If I lend 100*l.* at the rate of 5*l.* per cent per Annum, at the year's end I shall receive 5*l.* for the use of my money; likewise, if I draw a bill of 100*l.* for 12 months, and discount it immediately, Ishall have to pay 100d. per month, equal to 8s. 4d. and 12 times this for 12 months, or 5*l.* discount.

RULE.—Multiply the principle by the rate per cent. and divide by 100.

	£.	s.	d.
What is the interest of 500*l.* at 5 per cent.?	25	0	0
What is the interest of 700*l.* at 4 per cent.?	28	0	0
What is the interest of 1000*l.*at 3 per cent.?	30	0	0
What is the interest of 1800*l.* at 6 per cent.?	108	0	0
What is the in. of 20000*l.* for 5 yrs. at 5 p.c.?	5000	0	0
What is the in. of 150*l.* for 8 yrs. at 4 p. c.?	500	0	0
What is the in. of 400*l.* for 12 yrs. at 3 p. c.?	144	0	0
What is the interest of 800*l.* at 10 per cent.?	80	0	0
What is the discount of a 2 mo. bill of 30*l.*?	0	5	0
What is the discount of a 3 mo. bill of 50*l.*?	0	12	6
What is the discount of a 6 mo. bill of 100*l.*?	2	10	0
What is the discount of a 9 mo. bill of 200*l.*?	7	10	0
What is the discount of a 15 mo. bill of 500*l.*?	31	5	0
What is the dis. of a 18 mo. bill of 1000*l.*?	75	0	0
What is the commission of 800*l.* if I am allowed 5s. 6d. per cent.?	2	4	0
What is the commission of 1600*l.* if I am allowed 12s. 6d. per cent.?	10	0	0
What is the commission of 2000*l.* if I am allowed $1\frac{1}{4}$ per cent.?	25	0	0
What is the commission of 6000*l.* if I am allowed $2\frac{1}{2}$ per cent.?	150	0	0
What is the commission of 8000*l.* if I am allowed $5\frac{3}{4}$ per cent.?	460	0	0
What is the commission of 12000*l.* if I am allowed $7\frac{1}{2}$ per cent.?	900	0	0

Method of constructing simple interest table, for days.

£.
1
3
—
100)3
365),030000(,000082 column for 3 per cent.
2920 ,000164 for two days
———————
800
730
—
70 &c.

and thus having obtained the quotient for one day, double it for two, treble it for three &c.

Method of constructing simple interest table, for years.

£.
1
5 per cent
—
100)5
—
,05 column for 5 per cent.
05
—
,10 for 2 years
—
,15 for 3 years
—
,20 for 4 years
—
,25 for 5 years
—
,30 for 6 years.

and having thus obtained the interest for one year, double it for 2 years, treble it for 3 years. &c.

N. B. Use the same method for the other per cents. both in days and years.

The following table will be found highly useful in computing simple interest.

TABLE OF THE INTEREST OF £1, FOR ANY NUMBER OF DAYS, AT 3, 3½, 4, 4½, & 5 PER CENT.

No. of Days.	3 per cent.	3½ per cent.	4 per cent.	4½ per cent.	5 per cent.
1	,00008	,00009	,00010	,00012	,00013
2	,00016	,00019	,00021	,00024	,00027
3	,00024	,00028	,00032	,00036	,00041
4	,00032	,00038	,00043	,00049	,00054
5	,00041	,00047	,00054	,00061	,00068
6	,00049	,00057	,00065	,00073	,00082
7	,00057	,00067	,00076	,00086	,00095
8	,00065	,00076	,00087	,00098	,00109
9	,00073	,00086	,00098	,00110	,00123
10	,00082	,00095	,00109	,00123	,00136
20	,00164	,00191	,00219	,00246	,00273
30	,00246	,00287	,00328	,00369	,00410
40	,00328	,00383	,00438	,00493	,00547
50	,00410	,00479	,00547	,00616	,00684
60	,00493	,00572	,00657	,00739	,00821
70	,00575	,00671	,00767	,00862	,00958
80	,00657	,00767	,00876	,00986	,01095
90	,00739	,00863	,00986	,01109	,01232
100	,00821	,00958	,01095	,01232	,01369
200	,01643	,01917	,02191	,02465	,02739
300	,02465	,02876	,03287	,03698	,04109

Use of the foregoing table.

What is the interest of 348*l.* for 348 days, at 3, 4, and 5 per cent.?

	3 per cent.		4 per cent.		5 per cent.
300 days	= ,02465	=	,03287	=	,04109
40 do.	= ,00328	=	,00438	=	,00547
8 do.	= ,00065	=	,00087	=	,00109
	,02858		,03812		,04765
	348		348		348
	22864		30496		38120
	11432		15248		19060
	8574		11436		14295
	9,94584		13,26576		16,58220
	20		20		20
	18,91680		5,31520		11,64400
	12		12		12
	11,00160		3,78240		7,72800
			4		4
			3,2960		2,91200
	£9 18 11		£13 5 3$\frac{2}{4}$		£16 11 7$\frac{1}{5}$

TABLE OF INTEREST OF £1.

For any number of years not exceeding 25, at 3, 3½, 4, 4½, and 5 per cent.

No. of years	3 per cent.	3½ per cent.	4 per cent.	4½ per cent.	5 per cent.
1	,03000	,03500	,04000	,04500	,05000
2	,06000	,07000	,08000	,09000	,10000
3	,09000	,10500	,12000	,13500	,15000
4	,12000	,14000	,16000	,18 00	,20000
5	,15000	,17500	,20000	,22500	,25000
6	,18000	,21000	,24000	,27000	,30000
7	,21000	,24500	,28000	,31500	,35000
8	,24000	,28000	,32000	,36000	,40000
9	,27000	,31500	,36000	,40500	,45000
10	,30000	,35000	,40000	,45000	,50000
11	,33000	,38500	,44000	,49500	,55000
12	,36000	,42000	,48000	,54000	,60000
13	,39000	,45500	,52000	,58500	,65000
14	,42000	,49000	,56000	,63000	,70000
15	,45000	,52500	,60000	,67500	,75000
16	,48000	,56000	,64000	,72000	,80000
17	,51000	,59500	,68000	,76500	,85000
18	;54000	,63000	,72000	,81000	,90000
19	,57000	,66500	,76000	,85500	,95000
20	,60000	,70000	,80000	,90000	1,00000
21	,63000	,74500	,84000	,94500	1,05000
22	,66000	,77000	,88000	,99000	1,10000
23	,69000	,80500	,92000	1,03500	1,15000
24	,72000	,84000	,96000	1,08000	1,20000
25	,75000	,87500	1,00000	1,12500	1,25000

To find the interest of any sum for any time specified in the above two tables—for the days by the former table, and for the years by the latter table, which must be added together, and then multiplied by the principal.

What is the interest of 800*l.* for 20 years and 292 days, at 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, and 5 per cent.?

3 per cent.

,60000 = 20 years
,01643 = 200 days
,00739 = 90 days
,00016 = 2 days

,62398
800

499|18400
20

3|68000
12

8|16000—499*l.* 3s. 8d.

$3\frac{1}{2}$ per cent.

,70000 = 20 years
,01917 = 200 days
,00863 = 90 days
,00019 = 2 days

,72799
800

582|39200
20

7|84000
12

10|08000—582*l.* 7s. 10d.

4 per cent.

,80000 = 20 years
,02191 = 200 days
,00986 = 90 days
,00021 = 2 days

,83198
800

665|58400
20

11|68000
12

8|16000—665*l.* 11s. 8d.

$4\frac{1}{2}$ per cent.

,90000 = 20 years
,02465 = 200 days
,01109 = 90 days
,00024 = 2 days

,93598
800

748|78400
20

15|6800
12

8|16000—748*l.* 15s. 8d.

5 per cent.

1,00000 = 20 years.
,02739 = 200 days
,01232 = 90 days
,00027 = 2 days

1,03998
800

831|98400
20

19|68000
12

8|16000—831*l.* 19s. 8d.

TABLE,

Shewing the amount of £1. for a given number of years compound interest, at 3, 3½, 4, 4½, and 5 per cent.

No of years	3 per cent.	3½ per cent.	4 per cent.	4½ per cent.	5 per cent.
1	1,0300	1,0350	1,0400	1,0450	1,0500
2	1,0609	1,0712	1,0816	1,0920	1,1025
3	1,0927	1,1087	1,1248	1,1411	1,1576
4	1,1255	1,1475	1,1698	1,1925	1,2155
5	1,1592	1,1876	1,2166	1,2461	1,2762
6	1,1940	1,2292	1,2653	1,3022	1,3400
7	1,2298	1,2722	1,3159	1,3608	1,4071
8	1,2667	1,3168	1,3685	1,4221	1,4774
9	1,3047	1,3628	1,4233	1,4860	1,5513
10	1,3439	1,4105	1,4802	1,5529	1,6288
11	1,3842	1,4599	1,5394	1,6228	1,7103
12	1,4257	1,5110	1,6010	1,6958	1,7958
13	1,4685	1,5639	1,6650	1,7721	1,8856
14	1,5125	1,6186	1,7316	1,8519	1,9799
15	1,5579	1,6753	1,8009	1,9352	2,0789
16	1,6047	1,7339	1,8729	2,0223	2,1828
17	1,6528	1,7946	1,9479	2,1133	2,2920
18	1,7024	1,8574	2,0258	2,2084	2,4066
19	1,7535	1,9225	2,1068	2,3078	2,5269
20	1,8061	1,9897	2,1911	2,4117	2,6532
21	1,8602	2,0594	2,2787	2,5202	2,7859
22	1,9161	2,1315	2,3699	2,6336	2,9252
23	1,9735	2,2061	2,4647	2,7521	3,0715
24	2,0327	2,2833	2,5633	2,8760	3,2251
25	2,0937	2,3632	2,6658	3,0054	3,3863

Method of constructing the table for compound interest.

Let us take the column for 5 per cent.

£.
1
5 per cent.

100) 5,00(,05
5 00 1,00
· · ·

1,05 = 1 year.
5

100) 5,2500(,0525
1,05

1,1025 = 2 years.
5

100) 5,512500(,055125
1,1025

1,157625 = 3 years.
5

100) 5,788125(,05788125
1,157625

1,21550625 = 4 yr.
5

100) 6,07753125

,0607753125
1,21550625

1,2762815625 = 5 yr.

1,2762815625=5 yr.
5

100)6,3814078125

,063814078125
1,2762815625

1,340095640625=6yr.
5

100)6700478203125

,06700478203125
1,340095640625

1,40710042265625=7yr.
5

100)703550211328125

,0703550211328125
1,40710042265525

1,4774554437890625 = 8 years.
5

100)73772772189453125

,073772772189453125
1,4774554437890625

1,551228215978515625 = 9 years.

Money, at compound interest, is not unlike the small stream, which in its course collects many tributary waters, and becomes a mighty river, rolling its accumulated waves in majesty to the great deep; or the snowball, whose core was formed in the hand, but which in its descent to the plain rolled on increasing to a majestic size, increasing and increasing still according to its momentum and surface. We frequently hear people talk of money doubling itself every fourteen years, when put out at compound interest. But to set this idea in a clearer view and to give it more tangibility, let us suppose with Barlow, a penny put out at 5 per cent. compound interest, at the birth of Christ, and in 1810 it would have amounted to a sum exceeding in value 357 millions of globes, of standard gold, each in magnitude as large as this Earth!!! This is truly astonishing, and one would imagine sufficient to liquidate the National Debt, were it three hundred and fifty seven times larger than it is. But this is not all, money at compound interest doubles itself every 14 years. This calculation was made up to the year 1810. It is now 1829, or 19 years since, therefore by parity of reasoning, we must more than double the number of golden worlds this penny would have amounted to. The number at present cannot be stated at less than a thousand millions.

This may appear extravagant, and even incredible to some, but the following approximation, founded on the popular idea of money at compound interest doubling itself every fourteen years, may in some measure convince the most sceptical. Divide 1820 by 14 and we obtain the number of times the penny is to be doubled, viz. 130.—Therefore double the number one 130 times, & you will obtain the following result, when you shall have divided it also by 12 and 20 for pounds, 5,671372,782015,640057,722910,123862,803524; any one may do this for himself, and therefore he may remove any doubts at pleasure.

5,671372,782015,641057,722910,123862,803524.

The above is the amount in pounds of one penny at compound interest, for 1820 years, taking it for granted that money doubles itself every 14 years when allowed thus to accumalate, call this a dividend and find a divisor in the following manner;—

Suppose the earth to be 8000 miles in diameter.—Reduce this number into feet and cube them; after this multiply by ,5236, then again by 19260, the specified gravity of one solid foot of pure standard gold. Thus you obtain the weight in ounces of this globe of ours, if made of gold. Let us suppose each ounce worth six pounds, and for a divisor you obtain 4560,147597,527 875,584000,000,000; divide and you will have upwards of 12 hundred millions for the amount!!! A penny at compound interest would wipe off the national debt in 540 years! Divide this number by 14, and double 1 the required number of times, then divide by 12 and 20, and you will obtain a sum equal to the National Debt.

Operation.

double	1
	2
	4
	8
	16
	32
	64
	128
	256
	512
	1024
	2048
	4096
	8192
	16384
	32768
	65536
	131072
	262144
	524288
	1048576 = 20
	2097152
	4194304
	8388608
	16777216
	33554432
	67108864
	134217728
	268435456
	536870912
	1073741824
	2147483648
	4294967296
	8589934592
	17179869184
	34359738368

Brought over	34359738368	
	68719476736	
	137438953472	
	274877906944	
	549755813888	
	1099511627776	= 40
	2199023255552	
	4398046511104	
	8796093022208	
	17592186044416	
	35184372088832	
	70368744177664	
	140737488355328	
	281474976710656	
	562949953421312	
	1125899906842624	
	2251799813685248	
	4503599627370496	
	9007199254740992	
	18014398509481984	
	36028797018963968	
	72057594037927936	
	144115188075855872	
	288230376151711744	
	576460752303423488	
	1152921504606846976	= 60
	2305843009213693952	
	4611686018427387904	
	9223372036854775808	
	18446744073709551616	
	36893488147419103232	
	73786976294838206464	
	147573952589676412928	
	295147905179352825856	
	590295810358705651712	
	1180591620717411303424	
	2361183241434822606848	

Brought over	2361183241434822606848	
	4722366482869645213696	
	9444732965739290427392	
	18889465931478580854784	
	37778931862957161709568	
	75557863725914323419136	
	151115727451828646838272	
	302231454903657293676544	
	604462909807314587353088	
	1208925819614629174706176	= 80
	2417851639229258349412352	
	4835703278458516698824704	
	9671406556917033397649408	
	19342813113834066795298816	
	38685626227668133590597632	
	77371252455336267181195264	
	154742504910672534362390528	
	309485009821345068724781056	
	618970019642690137449562112	
	1237940039285380274899124224	
	2475880078570760549798248448	
	4951760157141421099596496896	
	9903520314283042199192993792	
	19807040628566084398385987584	
	39614081257132168796771975168	
	79228162514264337503543950336	
	158456325028528675187087900672	
	316912650057057350374175801344	
	633825300114114700748351602688	
	1267650600228229401496703205376	= 100
	2535301200456458802993406410752	
	5070602400912917605986812821504	
	10141204801825835211973625643008	
	20282409603651670423947251286016	
	40564819207303340847894502572032	
	81129638414606681695789005144064	
	162259276829213363391578010288128	

Brt. over 1622592768292133633915780102881283245185536584267267831560205762566490371073168534535663120411525121298074214633706907132624082305024259614842926741381426524816461004851922968585348276285304963292200961038459371706965525706099265844019220769187434139310514121985316880384415383748682786210282439706337607688307674973655724205648794126752153616615349947311448411297588253504307233230699894622896822595176507008614466461399789245793645190353014017228813292279957849158729038070602803445762658455991569831745807614120560689152531691198313966349161522824112137830410633823966279326983230456482242756608212676479325586539664609129644855132164253529586511730793292182592897102643285070591730234615865843651857942052864170141183460469231731687303715884105728340282366920938463463374607431768211456680564733841876926926749214863536422912

12)136112946768375385385349842972707284582 4

2|0)1134274556403128211544582024772560704 8|5|4

5,671372,782015 , 641057 , 722910 , 123862 , 803524 | 5 | 4

The above sum is a penny doubled 130 times, and then divided by 12 and 20.

Suppose the earth's diameter 8000 miles, and find a divisor to the above number, as follows :—

42240000 feet in the earth's diameter.
42240000

16896
8448
8448
16896

1784217600000000
42240000

71368704
35684352
35684352
71368704

75365351424000000000000
,5236

452192108544
226096054272
150730702848
376826757120

3946129800560640000000(0000cut off for decimals
19260 oz. in one solid foot

23676778803363840
789225960112128
3551516820504576
394612980056064

76002459958797926400000000(0000
6 pounds per oz.

456014759752787558400000000

This is the divisor, or the earth in oz. and value of pure standard gold.

```
4560147597527875584000000000)5671372782015641057722910123862803524(1,243,681,843
                             4560147597527875584000000000
                             ----------------------------
                             1111225184487765473722910123 8
                              912029519505575116800000000 0
                             ----------------------------
                             1991956649821903569229101238 6
                             1824059039011150233600000000 0
                             ----------------------------
                              167897610810753335629101238 62
                              136804427925836267520000000 00
                             ----------------------------
                              310931828849170681091012386 28
                              273608855851672535040000000 00
                             ----------------------------
                               373229729974981460510123862 80
                               364811807802230046720000000 00
                             ----------------------------
                                84179221727514137901238628 03
                                45601475975278755840000000 00
                             ----------------------------
                                38577745752235382061238628 035
                                36481180780223004672000000 000
                             ----------------------------
                                 20965649720123773892386280 352
                                 18240590390111502336000000 000
                             ----------------------------
                                 17250593300122715563862803524
                                 13680442792583626752000000000
                             ----------------------------
                                 3570150507539088811862803524
```

In words: Twelve hundred and forty three millions, six hundred and eighty one thousand, eight hundred and forty three ! ! ! !

PROFIT AND LOSS,

OR PERCENTAGE, WHETHER I LOSE OR GAIN.

To set per centage in a clear light in a few words, let us suppose we buy an article (a yard of cloth for instance) for 1*l.* and sell it for 1*l.* 5s. it is evident this 1*l.* so laid out in cloth, gains me a crown, then what is my gain per cent.?

If 1*l.* gains me a crown, 100*l.* will gain me 100 crowns, = 50 half pounds, = 25 whole pounds; therefore 5s. in the pound, gain or loss, is after the rate of 25 per cent., and vice versa, it is equally obvious if I had given 25s. for the yard of cloth, I should have lost after the rate of 25 per cent.

A crown per pound therefore is 25*l.* per cent. or 5s. per pound.

A halfcrown is $12\frac{1}{2}$*l.* per cent. or 2s. 6d. per pound.

Fifteen pence are $6\frac{1}{4}$*l.* per cent. or 1s. 3d. per pound.

A shilling is 5*l.* per cent. or 1s. per pound.

Sixpence is 50s. per cent. or 6d. per pound.

Threepence is 25s. per cent. or 3d. per pound.

Twopence is 16s. 8d. per cent. or 2d. per pound.

One penny is 8s. 4d. per cent. or 1d. per pound.

One halfpenny is 4s. 2d. per cent. or $\frac{1}{2}$d. per pound.

A shilling per shilling is cent. per cent.

Sixpence per shilling is 50*l.* per cent.

Threepence per shilling is 25*l.* per cent.

Twopence per shilling is 16*l.* 13s. 4d. per cent.

One penny per shilling is 8*l.* 6s. 8d. per cent.

One halfpenny per shilling is 4*l.* 3s. 4d. per cent.

If I buy 400 yards of Irish cloth, at 2s. 6d. per yard, and sell them out at 3s. 4d. per yard, what is the cost of the whole, and what do I gain per cent.?

halve 400 yards, or halfcrowns
200 crowns
100 half pounds
£50 the cost of the whole.

If I subtract the cost price per yard from the gain price, or in figures, 2s. 6d. from 3s. 4d. it will be seen I gain 10d. per yard, or 4000 pence, which according to the table, are 16*l.* 13s. 4d. the gain by the whole.

If I buy a gallon of gin for 10s. and retail it for 15s. what do I gain per cent. and how much in retailing 60 gallons?

5s. at 10s. or 10s. at 20s. is 50 per cent., and as I gain a crown per gallon, I shall gain 60 crowns for the whole, or 15*l.*

If I buy a tun of steel at 6d. per lb. and retail the same at 8d. what do I gain in the sale of 100 tuns, and how much per cent.?

In this question, 6d. gains me 2d. therefore 1s. gains me 4d. There are 112lbs. in one hundred weight, and twenty hundred weight in one tun, or 2240 lbs., therefore if I gained only 1 penny per lb. I should gain 2000 pence, and 240 pence, or 8*l.* 6s. 8d. and 1*l.* = 9*l.* 6s. 8d. but as I gain twopence per lb. I shall gain twice 9*l.* 6s. 8d. or 18*l.* 13s. 4d. per tun; and in the sale of 100 tuns, I shall gain 100 times 18*l.* or 1800*l.* 100 times 13s. or 1300s = 65*l.* and 100 times 4d. or 400d. = 33s. 4d. in the whole 1866*l.* 13s. 4d. My gain per cent. is 4d. per shilling, or 25*l.* and 8*l.* 6s. 8d. = 33*l.* 6s. 8d. according to the table.

SQUARE ROOT.

As the common method of extracting the square root may be found in any elementary work, I will not here insert it.

We will here introduce another method for extracting the square root. This, with some little variation, may be used for extracting the cube root, and it is undoubtedly more simple and less intricate than any hitherto used for extracting the root of the third power.

Point off the given number in periods of two figures, beginning as usual at the unit's place.

For the first root figure.

Find the highest square for the first period, and put the root (9) in the quotient. Subtract the square, (viz. 81 in this example from 85,) and to the remainder (4) bring down the second period (82) making together 482.

For the second root figure.

To find what the second root figure will be, multiply the quotient (9) by 20, and you obtain a divisor (180) for 482, which will give you the second root figure (2), put this in the quotient, and multiply, but do not subtract. Bring down the first and second periods in one sum, viz. 8582, and square your quotient (92), and put the square (8464) under 8582, and subtract. To the remainder (118) bring down the next period (54).

For the third root figure.

To find what the third root figure will be, multiply the quotient (92) by 20, and you obtain a divisor (1840) for 11854, which will give you the third root figure (6),

put this in the quotient, and multiply, but do not subtract. Bring down the first, second, and third periods in one sum, viz. 858254, and square your quotient (926) and put your square (857476) under 858254, and subtract, and so on, repeating the same for every root figure.

What is the square root of 8582540164?

$$
\begin{array}{rl}
 & 8582540164(92642 \\
 & 81 \\
\hline
9 \times 20 = 180) & 482(2 \\
 & 360 \\
\hline
 & 8582 \\
92^2 = & 8464 \\
\hline
92 \times 20 = 1840) & 11854(6 \\
 & 11040 \\
\hline
 & 858254 \\
926^2 = & 857476 \\
\hline
926 \times 20 = & 18520(77801(4 \\
 & 74080 \\
\hline
 & 85825401 \\
9264^2 = & 85821696 \\
\hline
9264 \times 20 = & 185280)370564(2 \\
 & 370560 \\
\hline
 & 8582540164 \\
92642^2 = & 8582540164
\end{array}
$$

ANOTHER METHOD.

Take the root of units and tens when your number does not exceed four figures, and place it in the quotient for units, divide hundreds and thousands by any number not exceeding the quotient figure by unity, and you obtain the other figure of the quotient which stands for tens.

What is the square root of 625?

625(25
25
---
3)6

2

Put this in the quotient for tens.

What is the square root of 1225?

1225(35
25
---
4)12

3

What is the square root of 2025?

2025(45
25
---
5)20

4

Put this in the quotient for tens.

What is the square root of 4225 ?

```
4225(65
  25
 ---
7)42
 ---
  6
```

Put this in the quotient for tens.

What is the square root of 5625 ?

```
5625(75
  25
 ---
8)56
 ---
  7
```

What is the square root of 7225 ?

```
7225)85
  25
 ---
9)72
 ---
  8
```

What is the square root of 9025 ?

```
 9025(95
   25
  ---
10)90
  ---
   9
```

What is the square root of 11025?

```
11025(105
  25
 ---
11)110
 ---
  10
```

What is the square root of 13225?

```
13225(115
  25
 ---
12)132
 ---
  11
```

Put this in the quotient for tens and hundreds.

What is the square root of 22500?

```
 . . .
22500(150
1
-
cancel 1
 ------
 2500(50
 2500
```

What is the square root of 62500?

```
 . . .
62500(250
4
-
cancel 2
 ------
 2500(50
 2500
```

What is the square root of 122500?

```
  . . .
122500(350
 9
 —
cancel 3
 ———
  2500
  2500
```

What is the square root of 202500?

OPERATION AND RULE.

```
  . . .
202500(450
16
 ———
```

cancel 4 this figure and bring down the remainder

```
  2500(50
  2500
```

Whatever may be the highest root to the first point, there will be the same figure to cancel, and after this it will be seen that 5 is the root of 25 or 50 of 2500, which place after the highest root obtained previously, and you have the true quotient in a moment.

What is the square root of 302500?

```
  . . .
302500(550
25
 —
cancel 5
 ———
  2500 50
  2500
```

What is the square root of 422500?

422500(650
36
—
cancel 6
———
2500(50
2500

What is the square root of 562500?

562500(750
49
—
cancel 7
———
2500(50
2500

What is the square root of 722500?

722500(850
64
—
cancel 8
———
2500(50
2500

What is the square root of 902500?

902500(950
81
—
cancel 9
———
2500(50
2500

CUBE ROOT.

As the common method of extracting the cube root may be found in any elementary work. I will not here insert it.

Another and a very simple method of extracting the cube root is as follows. Point off the given number in periods of three figures, beginning at the units place. Find the root of the last period, that is, the period on the left hand side of the number, subtract this root as in the following example, where 64 is taken from 99, to the remainder 35 bring down the next period 252, and seek a divisor by multiplying the square of the quotient (that is 16) by 300,* and the product 4800, will be the new divisor which is contained in 35252 six times. Set this 6 in the quotient. Bring down the two periods, 99 and 252, into one sum, 99252, now cube the quotient 46, and place its product 97336 under the dividend; subtract the cube from this dividend, and to the remainder 1916, bring down the next period in the dividend, viz. 847. Square the quotient 46, and multiply this square by 300, for a divisor; find how often it is contained in 1916847, viz. three times: set this 3 in the quotient. Bring down the whole dividend, 99,252,847, cube the quotient 463, and subtract its product as before, and so on till the dividend is exhausted :—thus,

* N. B. In the square root we always multiply by 20, but in the cube root by 300, and by one method (with the above variation) both roots may be obtained.

99,252,847(463
64 = cube of 4

$4^2 \times 300 = 4800)35252(6$
28800 do not subtract

99252
$46^3 = 97336$

$46^2 \times 300 = 634800)1916847(3$
1904400 do not subtract

99252847
$463^3 = 99252847$

THE FUNDS.

Purchasing of Stock, or the rise and fall of the Funds is the most delicate test of a nation's prosperity or adversity. Various causes influence the money market. The aching of the king's little toe will depress it, and when his countenance beams with joy, and gladness sits in his face, it looks up again.—His age will influence it. In short, the money market has been ruled by his majesty's health for some time. The commotions in Lancashire and Yorkshire influenced it; but war is the grand mover. Good or bad news always operates beneficially or banefully on the funds. A little before the battle of Waterloo, 3 per cents. sunk as low as 44 guineas, and ranged between

50 and 60 generally. They range generally between 80 and 90 now, I mean 3 per cents. red. and con.— During the first week in November, 1828, the reduced 3 per cents. ranged between $85\frac{7}{8}$ and $85\frac{5}{8}$, or in other words, you might have bought £100. of this stock for £85. and some shillings. The denominator of the fraction, I mean the lower number, indicates into how many parts the pound is divided, and in this instance it is divided into eight parts, or in other words into halfcrowns, and the numerator or upper number specifies the number of these parts you must take, and here it is seven at the beginning of the week and five at the end. Seven halfcrowns are 17s. 6d. and five halfcrowns are 12s.6d. and in the interim or intermediate days we find $\frac{3}{8}$, $\frac{5}{8}$, and two holidays. $\frac{3}{8}$ = 7s. 6d. and $\frac{5}{8}$ = 12s. 6d. or as I said before, three halfcrowns and five halfcrowns. $\frac{1}{2}$ would be ten shillings, meaning one-half of a pound, and $\frac{1}{4}$ would be five shillings, or one-quarter of a pound.— The cons. 3 per cents. ranged between $85\frac{1}{4}$ and $85\frac{3}{4}$.— The lower number 4, means the number of parts the pound is divided into, namely 4, or crowns; $85\frac{1}{4}$*l.* being equal to 85*l.* 5s., $85\frac{3}{4}$*l.* being equal to 85*l.* 15s.— During the intermediate days, $\frac{1}{8}$, $\frac{3}{8}$, and two holidays are the statements; $\frac{1}{8}$ being equal to one halfcrown, and $\frac{3}{8}$ being equal to three halfcrowns.

The $3\frac{1}{2}$ per cents. ranged $86\frac{1}{4}$ = 86*l.* 5s.
$94\frac{7}{8}$ = 94*l.* 17s. 6d.

and should any kind of stock have the fraction $\frac{1}{3}$ or $\frac{2}{3}$, it will be once 6s. 8d. or twice 6s. 8d. = 13s. 4d. Suppose $3\frac{1}{2}$ per cents. next week be stated at $86\frac{1}{3}$ or $85\frac{2}{3}$,

read 86*l.* 6s. 8d. or 85*l.* 13s. 4d. because 6s. 8d. is one-third, and 13s. 4d. is two-thirds; if $\frac{1}{5}$ be attached, read the pounds as stated, and 4 shillings, because $\frac{1}{5}$ are 4s., $\frac{2}{5}$ are 8s., $\frac{3}{5}$ are 12s., $\frac{4}{5}$ are 16s.

What is the annual interest of the National Debt, taking it at 800,000,000*l.* and $3\frac{1}{2}$ per cent.?

800,000,000
$3\frac{1}{2}$

2,400,000,000
400,000,000

100)2,800,000,000

28,000,000

To this sum may be added the expenses of collecting it—something handsome.

National Debt means money lent by the nation to government, to pay the interest for which there are certain revenues set apart. When the war expenses exceeded the produce of the taxes, goverment borrowed money on their security at sundry times, until the debt now amounts to more than 800,000,000*l.* the annual interest of which exceeds 30,000,000*l.*!!! If I could buy 100*l.* stock for 60*l.* I should receive lawful interest for my money; or 100*l.* for 80*l.* at 4 per cent.; or 100*l.* at $3\frac{1}{2}$ per cent. for 70*l.* About 1790, certain sums were put out at compound interest for the reduction of the National Debt, and the commissioners for that purpose redeemed upwards of 200 millions, some few years back.

The most effectual, certain, and speedy way of getting rid of this dead weight, would be the laying of a tax on each individual throughout the nation. And were this aided by the liberal contributions of those who choose to be so patriotic, by testamentary bequests, and other ways and means which might be adopted, a sum might easily be raised, which in a few years would be equivalent to the liquidation of the whole debt. But alas, this is not likely to be the case! There are many obstacles in the way of its accomplishment. At present it is a serious evil, but at some future period when backed by others, it will become truly appaling and formidable. It is now a matter of choice, but before its abolition it must be come a matter of necessity, and here the danger lies. The evil day will come, however long put off, unless preventative measures be adopted.

The reign of George the IV. is like a calm and sunshiny day after a few stormy and boisterous days. It is fine and glorious in itself, but occasionally ruffled by the consequences of former times. Though the winds are now still, and though the day is fine, the waters are in commotion, and sometimes dash their foaming billows upon our unprotected persons; and though we may look on with unconcern, and derive some secret pleasure from our imagined security, we cannot escape occasional suffering. But may one mighty billow never reach us when

"Waves behind push on the wave before."

THE COTTON MARKET.

This market is held as well in Manchester and London, as Liverpool, but chiefly in the last mentioned town, as being the nearest seaport town to Manchester, where this staple is chiefly manufactured. Saturdays and Mondays are the busy days of sale. Cotton is grown both in the East and West Indies, as well as in Egypt. But the two Americas (North and South) produce the most. It grows in a pod like peas and beans, but not exactly of the same shape. It is sold at so much per lb.; and that kind of cotton called Boweds, is most called for, which sells at present for 5d., 6d., or 7d. per lb., according to quality. The third week in October, about 10,000 bags were sold at $6\frac{1}{2}$d. to $6\frac{7}{8}$d. All know what a halfpenny is, but all do not know what $\frac{7}{8}$ is. To divide the penny into eight parts may seem needless to some, because it is lower than the coin of the realm descends. We know forsooth what a farthing is, and we may form some idea what half a farthing is, but you say why make a bargain in a coin which does not exist, which has no being, and for which there seems no need; as even farthings themselves have almost disappeared, from disuse. But though there seems no need of all this nicety to us at first sight, we shall readily grant it for the following consideration:—Factors may well stickle even about one eighth, because in the purchase of 10 or 20 thousand bags we have to take into consideration that each bag weighs more than a pound; 10,000 is to be multiplied by the weight of each bag;

but in the purchase of only 10,000 lb. you may see what difference even the advance of $\frac{1}{8}$ in the pound makes in the purchase of the whole. 10,000 one-eighths are equal to 5000 farthings, and these are equal to 2500 halfpennies, and these = 1250d. = 5*l*. 4s. 2d., so that in the purchase of 10,000 lb. only, and not 10,000 bags, the advance of only one eighth per lb. makes a difference in the whole purchase of 5*l*. 4s. 2d each time, but in the purchase of 10,000 bags, supposing each bag to weigh 500 lb. it would be an advance of upwards of 2600*l*. each time, a very round sum of money for so trifling a move of $\frac{1}{8}$ of a penny per lb., which proves that cotton brokers and buyers should be decent calculators and know what they are about.

(1) 2)16000 lb. at 6d. per lb.

20)8000

£400 would be

(2) 4|0)16000 lb. at $6\frac{1}{8}$d. per lb.

400 8)16000

$\frac{1}{8}$ = 8 6 8 12)2000d. or by table

408*l*. 6s. 8d. 8*l*. 6s. 8d.

(3) 4|0)1600|0 lb. at $6\frac{2}{8}$d. or $6\frac{1}{4}$d.

400

$\frac{2}{8}$ = 16 13 4

£416 13 4

(4) 4|0)1600|0lb. at $6\frac{3}{8}$d.

400

$\frac{3}{8}$ = 25

£425

(5) 4|0)1600|0lb. at $6\frac{1}{8}$d. or $6\frac{1}{2}$d.

400

$\frac{4}{8}$ = 33 6 8

£433 6 8

(6) 40)12000lb. at $6\frac{1}{3}$d.

300

16 13 4

£316 13 4

3)12000

4000

4 3 4

4

16 13 4

(7) 40)12|000lb. at $6\frac{2}{3}$d.

300

$\frac{2}{3}$ = 33 6 8 by table

£333 6 8

12000

2

3)24000

8000d. or by table
333*l.* 6*s.* 8*d.*

LIVERPOOL COTTON MARKET.

THE REPORT.

November 3rd.

The sales amount to 16540 bags of which the following are the particulars.

Bags.		cwt.	qr.	lb.
6970	Bowed at 6¼d. to 6⅞d. per lb.	2	3	0
2390	Orleans at 7d. to 7¼d. per lb.	3	1	0
4300	Alabama & Mobile at 5¾d. to 7d. per lb.	2	3	26
360	Sea Island, 14½d. to 16½d. per lb.....	2	2	14
30	Stained do. 7d. to 8½d. per lb.	2	1	0
580	Pernambuco 8d. to 8¼d. per lb.....	1	1	6
520	Maranham, 7⅝d. to 7⅞d. per lb.....	1	3	16
300	Bahia, 7⅝d. to 7¾d. per lb.....	1	2	26
390	Egyptian, 7¾d. to 8½d. per lb.	2	1	0
10	Carthaginia, 4⅞d. per do.	1	2	0
190	Demarara, 7¼d. to 8¾d. per lb.....	2	3	16
10	Barbados, 12¾d. per lb.....	1	3	20
430	Surat, 3⅞d. to 5½d. per lb.....	3	3	20
60	Bengal, 4¼d. to 5¼d. per lb.	3	2	0
16540				

We will take each kind separately, and suppose so many bags at the highest price, and so many at the lowest.

Bags.	each	lb.	at	d.	qr	per lb.	£.	s.	d.	kind of cotton
6000		308		6	$\frac{1}{4}$		48125	0	0	Boweds.
970		308		6	$\frac{7}{8}$		8558	4	7	
2000		364		7			21233	6	8	Orleans.
390		364		7	$\frac{1}{4}$		4288	7	6	
4000		336		5	$\frac{3}{4}$		32200	0	0	Alabama and
300		336		7			2940	0	0	Mobile.
300		294		14	$\frac{1}{2}$		5323	15	0	Sea Island.
60		294		16	$\frac{1}{2}$		1212	15	0	
20		252		7			147	0	0	Stained.
10		252		8	$\frac{1}{2}$		89	5	0	
500		146		8			2433	6	8	Pernams.
80		146		8	$\frac{1}{4}$		401	10	0	
500		212		7	$\frac{5}{8}$		3367	14	2	Maranham.
20		212		7	$\frac{7}{8}$		139	2	6	
200		194		7	$\frac{5}{8}$		1232	14	2	Bahias.
100		194		7	$\frac{7}{8}$		636	11	3	
300		252		7	$\frac{3}{4}$		2441	5	0	Egyptian.
90		252		8	$\frac{1}{2}$		803	5	0	
10		168		4	$\frac{7}{8}$		34	2	6	Carthaginia.
100		324		7	$\frac{1}{4}$		978	15	0	Demarara.
90		324		8	$\frac{3}{4}$		1063	2	6	
10		328		12	$\frac{3}{4}$		174	5	0	Barbados.
400		440		3	$\frac{7}{8}$		2841	13	4	Surat.
30		440		5	$\frac{1}{2}$		302	10	0	
30		392		4	$\frac{1}{4}$		208	5	0	Bengal.
30		392		5	$\frac{1}{4}$		257	5	0	
16540										

Ye German Princes who starve in a garret on ten or fifteen pounds a year, lest ye should soil your hands or pollute your minds with trade, look here! In a day when "much was not doing" 150,000*l.* were expended on the raw material at one place, and if on an average so much money be expended every day, look at Lancashire's industry, whose demands are so urgent in the manufacture of cotton. Thousands of persons derive their daily bread from it in an honest comfortable manner, and tens of thousands are busily employed in it, running to and fro on the face of the earth. The sea is likewise intersected from East to West, from North to South with ships; some in distributing the material in its manufactured state—some in procuring die woods to ornament it with various colours—some in importing it from the grower—some from Egypt—some from America—some from the Indies.

On land—

Some make ropes and some make sails,
Some build ships and some make nails.

On sea—

Some come from East and some from West,
And all men try to do their best.

Success to the trade of England!!!

TABLE
OF
Annuities, Pensions, Servants' Wages, &c. &c.

Days.	5*l.*		6*l.*		7*l.*		8*l.*		9*l.*		10*l.*		11*l.*		12*l.*		13*l.*		14*l.*		15*l.*		16*l.*		17*l.*		18*l.*		19*l.*		20*l.*	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s*	*d.*	*s.*	*a.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
1	0	3¼	0	3¾	0	4½	0	5¼	0	5¾	0	6½	0	7	0	7¾	0	8¾	0	9	0	9¾	0	10½	0	11	0	11¾	1	0¼	1	1
2	0	6½	0	7¾	0	9	0	10½	0	11¼	1	1	1	2¼	1	4	1	5	1	6¼	1	7½	1	9	1	10¼	1	11½	2	0¾	2	2¼
3	0	9¾	0	11¾	1	1¾	1	3¾	1	5¾	1	7½	1	9½	1	11½	2	1½	2	3½	2	5½	2	7½	2	9½	2	11	3	1¼	3	3¼
4	1	1	1	3¾	1	6¼	1	9	1	11½	2	2	2	4¾	2	7½	2	10	3	0¾	3	3¼	3	6	3	8½	3	11¼	4	1¾	4	4½
5	1	4¼	1	7½	1	10¾	2	3½	2	5	2	8¾	3	0	3	3¼	3	6¾	3	10	4	1¼	4	4½	4	7¾	4	11	5	2¼	5	5¾
6	1	7½	1	11½	2	3½	2	7½	2	11½	3	3¼	3	7¼	3	11¼	4	3¼	4	7	4	11	5	3	5	7	5	11	6	2¾	6	6¾
7	1	11	2	3½	2	8	3	0¾	3	5¼	3	10	4	2½	4	7	4	11¾	5	4¾	5	9	6	1½	6	6¼	6	10¾	7	3¼	7	8
8	2	2¼	2	7½	3	0¾	3	6	3	11½	4	4½	4	9¾	5	3	5	8¼	6	1½	6	6¾	7	0	7	5¼	7	10½	8	4	8	9
9	2	5½	2	11½	3	5½	3	11¼	4	5¼	4	11	5	5	5	10¾	6	4¾	6	10¾	7	4	7	10¾	8	4½	8	10½	9	4¼	9	10¼
10	2	8¾	3	3¼	3	10	4	4½	4	11	5	5¾	6	0¼	6	6¾	7	1¼	7	8	8	2½	8	9	9	3¾	9	10¼	10	4¾	10	11½

Table of Annuities, Pensions, Servants' Wages, &c. &c. continued.

Days.	5*l.*	6*l.*	7*l.*	8*l.*	9*l.*	10*l.*	11*l.*	12*l.*	13*l.*	14*l.*	15*l.*	16*l.*	17*l.*	18*l.*	19*l.*	20*l.*
	s. *d.*	*s.* *d.*	*s* *d.*	*s* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
20	5 5¾	6 6½	7 8	8 9	9 10¼	10 11½	12 0½	13 1¾	14 2¾	15 4	16 5¼	17 6¼	18 7½	19 8½	20 9¾	21 11
30	8 2½	9 10¼	11 6	13 1½	14 8¾	16 5¼	18 0¾	19 8¼	21 4½	23 0	24 7¾	26 3¾	27 11¼	29 7	31 2¾	32 10½
40	10 11	13 2	15 4	17 6¼	19 8¼	21 7¼	24 1¼	26 3½	28 3¾	30 8	32 10½	35 0¾	37 3	39 5¼	41 7½	43 10
50	13 8¼	16 5¼	19 2	21 2	24 3	27 4	30 1½	32 10½	35 7¼	38 4	41 1	43 10	46 6¾	49 3¾	52 0	54 9½
60	16 5¼	19 7½	23 0	26 3	29 6¾	32 10½	36 1½	39 4¼	42 9	46 0	49 3¾	52 6¾	55 10½	59 1½	62 5¼	65 9
70	19 1¼	23 0	26 10	30 8	34 6	38 4¼	42 2¼	46 0¼	49 10¼	53 8¼	57 4¾	60 3¼	65 0¾	68 10¾	72 10¼	76 8½
80	21 11	26 3½	30 8	35 4	39 5¼	43 10	48 2½	52 7	56 11¾	61 4½	65 9	70 1½	74 6¼	78 10¾	83 3¼	87 8
90	24 7¾	29 6¾	34 6	39 8½	44 4¼	49 3¾	54 2¾	59 1¾	64 1	69 0¼	73 11½	78 10½	83 10	88 9	93 8	98 7½
100	27 4¾	32 10½	38 4¼	43 10	49 3¾	54 9½	60 3¼	65 9	71 2¾	76 8½	82 2¼	87 8	93 1¾	98 7½	104 1¼	109 11¾
200	54 9½	65 9	76 8½	87 8	98 7½	109 7	120 7½	131 6	142 5½	153 5	164 4½	175 4	186 3½	197 3	208 2½	219 10½
300	82 2¼	98 7½	115 0¾	131 6	147 11¼	164 4½	180 10¾	197 3	213 8¼	230 1½	246 6¾	263 0	279 5¼	295 10½	312 3¾	329 10¼
monthly	8 4	10 0	11 8	13 4	15 0	16 8	18 4	20 0	21 8	23 4	25 0	26 8	28 4	30 0	31 8	33 4
quarterly	25 0	30 0	35 0	40 0	45 0	50 0	55 0	60 0	65 0	70 0	75 0	80 0	85 0	90 0	95 0	100 0
half yrly.	50 0	60 0	70 0	80 0	90 0	100 0	110 0	120 0	130 0	140 0	150 0	160 0	170 0	180 0	190 0	200 0

The use of this table is obvious to any one acquainted with the figures, and it may be depended on for accuracy. Every amount was a distinct calculation, and cost much time and labour. If any annuitant, pensioner, or servant has an income of five pounds per annum, he may, by inspecting this table, immediately see how much it is per day, or number of days; he may likewise see how much it is per week, per month, per quarter of a year, per half year, and so on with respect to any other annuity, pension, or wage, not exceeding twenty pounds per annum. If I part with my servant seven days before the expiration of his year, how much shall I have to give him at the rate of 16*l.* wages per annum.

The year 365 days		£.	s.	d.
7 off	300 days at 16*l.* per ann. =	13	3	0
——	50 do. at do. =	2	3	10
358	8 do. at do. =	0	7	0
		£15	13	10

This will be found sufficiently accurate for either man or master, though on account of a remainder to each operation it cannot possibly be accurate to the very farthing, though the variation will never much exceed this small coin.

MISCELLANEOUS QUESTIONS.

1 There are two globes of 36 inches circumference; the one is to be gilded, the other painted; how many square inches have I to charge for on the one, and how many square feet of painting on the other?

Divide the circumference (36) by 3,1416, for the diameter.

```
3,1416)36,0000(11,459 the diameter
       31416
       -----
        45840
        31416
        -----
        144240
        125664
        ------
         185760
         157080
         ------
          286800
          282744
          ------
            4056, &c.
```

Multiply the circumference by the diameter for the Ans.

```
   11,459
      36
   ------
   68 754
  343 77
  -------
144{12)412,524 inches of gilding
   {12) 34,377
   ------------
    2,86475 almost 3 feet of painting.
```

2 A gentleman being suspicious of some unfairness in his granary, was determined either to prove it or prevent it. He ordered bins to be constructed all round the room for the reception of his corn, each bin of equal dimensions in length, breadth, and depth, namely three yards. There were four at each side, and three at each end, pray how much corn would they contain?

RULE.—Multiply length, breadth, and depth for content.

yards
3
3
—
9
3
—
27
27 solid feet in one yard
—
34
20
—
680
49
—
729
1728 inches in one solid foot
—
5832
1458
5103
729
—
1259712

2150,42 solid in. in a bush.

2150,42)1259712,00(585$\frac{3}{4}$
1075210

1845020
1720336

1246840
1075210

171630
4

686520(3
645126

41394

$2 \times 7 = 14$ bins

1171$\frac{1}{2}$
7

8)8,200$\frac{1}{2}$ bushels in all.—Ans.

1,025 quarters.

3 Divide twenty shillings between A, B, C, and D. Give A one-third, B one-fourth, C one-fifth, D one-sixth; what is each man's share of the pound?

This question is sometimes proposed as a catch. If you add together the several parts of a pound as specified in the question, you will see that they amount to nineteen shillings only, though you are sure that one-third of a pound is 6s. 8d. that one-fourth is 5s. that one-fifth is 4s. and that one-sixth is 3s. 4d. But you know that if we add seven equal parts of a pound, viz. 2s. 6d. together, they will not amount to a pound, because there is a part wanting, therefore if you add four unequal parts of a pound, viz. 6s. 8d. and 5s. and 4s. and 3s. 4d. they will not amount to a pound, because there is a part wanting, viz. one-twentieth. But by proportion you may obtain the one-third, the one-fourth,

the one-fifth, and one-sixth of a pound, whose sum shall make the same,—thus,

	s.		s.	d.		s.	d.	
As	19	: 20 : :	6	8	:	7	0	$\frac{192}{228}$
	19	: 20 : :	5	0	:	5	3	$\frac{12}{19}$
	19	: 20 : :	4	0	:	4	$2\frac{1}{2}$	$\frac{2}{19}$
	19	: 20 : :	3	4	:	3	6	$\frac{96}{228}$

} = 20s. Ans.

4 Suppose a tap capable of discharging a cubic foot of water in 1 minute, how long would it be in discharging a cubic mile at the same rate?

It is evident that as many solid cubic feet as there are in a cubic mile, it will require so many minutes to discharge the water.

1760 yards per mile
3

5280 cubic feet per mile
5280

422400
10560
26400

27878400
5280

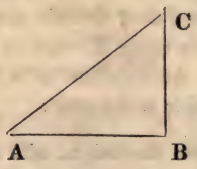
2230272000
55756800
139392000

min. per year 525960)147197952000(300,000 years nearly
1577880

Thus it appears that it would require nearly three hundred thousand years! and old as the world is, nearly fifty thousand times its age!! upwards of ten thousand, supposing the pipe to discharge a cubic yard per minute!

5 Two thieves having succeeded to their wishes, started at four o'clock in the morning, in different directions. Jack went due north, at the rate of eight miles an hour. Ned went due west at the rate of six miles an hour. They both stopped at 12 o'clock at noon. A police-officer pursued Jack and took him before he proceeded further in his flight. He then obtained information of the direction Ned had taken—took the nearest road, and apprehended him immediately; how far did he travel in pursuit of the thieves, before he took them both into custody?

As one went due north and the other due west, a figure of this description might be traced out as an illustration.



Square A B and B C, and add the two squares together, then take the square root for A C. Add A C and B C for the Answer. Thus,

8 hours	6
8 miles	8
Jack travelled 64 miles	Ned 48 miles
64	48
256	384
384	192
4096	2304
2304	
6400(80 A C	
64 64 B C	

Ans. 144 miles.

This is commonly called the Pythagorean Problem.—It is the forty-seventh of the first book of Euclid.—Pythagoras was so thankful and overjoyed when he discovered it that he sacrificed an Hecatomb to the gods, out of gratitude. Others in our own country, in imitation of the original discoverer, when they supposed that they had obtained clear ideas respecting all its properties, have feasted their friends and neighbours with two or sometimes as many fat oxen as their circumstances would allow. An hecatomb is a hundred fat oxen offered up in sacrifice to the gods.

6 Wanting to know the height of a may-pole, I measured its shadow and found it to be 200 feet; I then held my 5 feet staff perpendicular and found its shadow to be 4 feet; from hence it is required to determine the height of the may-pole?

This is merely a sum in proportion, but by it when the sun shines, the height of any object, as trees, buildings, &c. may be ascertained.

RULE.—As little shadow is to little height, so is great shadow to great height. Thus,

ft. shad.		ft. high.		ft.
As 4	:	5	: :	200
				5
				4)1000
				Ans. 250 feet.

N. B. This is the height of York Cathedral.

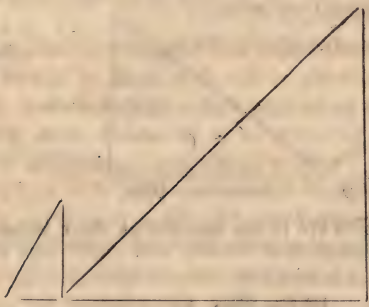


figure.

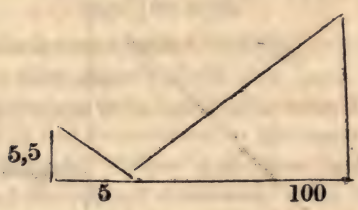
7 Being desirous of finding the height of a steeple, I placed a mirror on the horizontal plane, at the distance of 100 feet from the steeple's base. I then walked back 5 feet, and saw the top of the steeple appear in the centre of the mirror,—required the steeple's height, my eye being 5 feet and a half from the ground?

Another method which may be used when the sun does not shine.

RULE.—As your distance from the centre of the glass is to the height of your eye, so is the distance between the glass and the object, to the object's height. Or thus,

	feet.			
As 5	:	5,5	: :	100
				55
				5)550,0
				Ans. 110 feet

This is preferable, but requires greater accuracy than the preceding one.



Similar triangles are to one another as their homologous sides.

Wells, Pits, &c.

8 What would be the expense of digging a well, 30 yards deep, and one in diameter, at 7s. 6d. per solid yard?

Before we enter upon the solution of this question, let us attend to the following illustration. Let us suppose a square well to be dug, whose side is one yard, and let

us suppose this yard to be divided into 100 equal parts,—it is commonly divided into 36 equal parts, for inches.

The side of my square being 100, multiply by the same, thus, 100

10000

We here perceive there would be ten thousand small squares in the surface of this square well, but in a circular well of a yard in diameter, there would only be ,7854. Therefore square the diameter of your well, pit, &c. and multiply by the decimal number ,7854, and you obtain the area of the top, which being multiplied by the depth (30 yards) will give you the solidity.

Area here ,7854 parts of a square yard divided into 10000 30

make 23,5620 solid yards, or 24 yards nearly.

24 crowns are 3*l.*

24 halfcrowns are 1*l.* 10s.

£4 10 cost of digging.

9 Supposing a Cornwall shaft to be 200 fathoms deep, and 10 feet diameter. how many solid yards were taken out in excavating it? $10 \times 10 = 100 \times ,7854 = 78,5400 \times 1200$ feet $= 94248$ feet, this being divided by 27, will give $3490\frac{2}{3}$ yards.—Ans.

The deepest mines in this island are about Whitehaven, where coal is brought from under the sea. The descent to it lies through spacious chambers or galleries. The salt mines in Cracow, in Poland, likewise the mines

of Hungary and Peru, are the most spacious and deep, but there are so many descriptions of them in other works, that we will not here pursue the subject any further. Peru is in South America.

America was discovered in the year 1491, by Christopher Columbus, though it took its name from Amerigo Vespucci, a Venetian. That the earth is round admits not of any doubt. It may be inferred from the earth's shadow, as seen in an eclipse; from the uniform circular appearance of all heavenly bodies; from the going out and coming in of ships; and likewise from the circumnavigation of the globe by several celebrated mariners. Before the time of Columbus, all travellers proceeded eastward, to the East Indies, China &c. and from the shape of the earth Columbus concluded that if he sailed due West he must arrive there too, unless he should be impeded by some unknown tract of land, of which he had some suspicions. The Azores or Canary Islands lie in the Atlantic Ocean, and during his stay there, some trees came floating in at one time different to any known in Europe, also two or three pieces of curiously carved wood at another, and the bodies of two men were washed up, whose features were strikingly different to European. From these data, and the unequal accumulation of matter in the Eastern Empire, he thought there must be a Western Empire on the opposite side, as a balance or equipoise, and therefore he felt assured of success.

After application to several courts of Europe without success, he at length obtained a small fleet from Fer-

dinand and Isabella, of Spain, and then sailing four thousand miles across the Atlantic, he succeeded in the discovery of the New World, where he found all nature on a more magnificent scale than in the Old.—The trees seemed to hide their heads in the clouds;—spiders and frogs were of enormous sizes; earth-worms, the length and thickness of one's arm; and vegetation extremely luxuriant beyond all description; gold and silver plentiful and even abundant, and in little estimation by the natives, who used it instead of iron for the common purposes of life. We may easily imagine the effect such an unexpected discovery had on the different nations of Europe.

PERMUTATION.

10 How many changes may be rung upon 12 bells, and how long would they be in ringing but once over, supposing ten changes might be rung in a minute, and the year to contain 365 days, 6 hours?

$1\times 2\times 3\times 4\times 5\times 6\times 7\times 8\times 9\times 10\times 11\times 12 =$ 479001600 changes, which $\div$ 10 = 47900160 min. and if reduced is 91 years, 3 weeks, 5 days, 6 hours.

The Alphabet.

11 How many different positions might twenty-six persons assume at table, and supposing they were called by the several names of the alphabet, how many days would they have to remain at the same house for the discussion of each other's nature and claims, before the changes should be exhausted, supposing they assume a different position every minute, night and day?

$1\times2\times3\times4\times5\times6\times7\times8\times9\times10\times11\times12\times13\times14\times15\times16\times17\times18\times19\times20\times21\times22\times23\times24\times25\times26,$
$= 403291461126605635584000000$ changes.
or 28006351467125391360000 days.

"It is much to be lamented, that the alphabet, which has produced and preserved almost all the improvements in other arts and sciences, should have itself received no improvement in modern times; which have added so much elucidation to almost every branch of knowledge that can meliorate the condition of humanity. Thus in our present alphabets many letters are redundant, others are wanted; some simple articulate sounds have two letters to suggest them; and in other instances two articulate sounds are suggested by one letter. Some of these imperfections in the alphabet of our own language shall be here enumerated.

X. Thus the letter x is compounded of ks, or of gz, as in the words excellent, example; eksellent, egzample.

C is sometimes k, at other times s, as in the word access.

G is a single letter in go; and suggests the letters d and the French J in pigeon.

Qu is kw, as quality is kwality.

N G in the words long and in king is a simple sound like the French n, and wants a new character.

SH is a simple sound, and wants a new character.

TH is either sibilant as in thigh, or semivocal as in thee; both of which are simple sounds, and want two new characters.

J French exists in our words confusion, and conclusion, judge, pigeon, and wants a character.

J consonant, in our language, expresses the letters d, and the French j conjoined, as in John, Djon.

CH is either k as in Archangel, or is used for a sound compounded of Tsh, as in children, tshildren.

GL is dl, as glove is pronounced by polite people dlove.

CL is tl, as cloe is pronounced by polite speakers tloe.

The spelling of our language in respect to the pronunciation is also wonderfully defective, though perhaps less so than that of the French; as the words slaughter and laughter are pronounced totally different, though spelt alike. The word sough, now pronounced suff, was formerly called sow; whence the iron fused and received into a sough acquired the name of sow metal;—and that received into less soughs from the former one obtained the name of pigs of iron or of lead; from the pun on the word sough, into sow and pigs. Our word jealousies contains all the vowels, though three of them only were necessary: nevertheless in the two words abstemiously and facetiously the vowels exist all of them in their usual order, and are pronounced in their most usual manner.

Some of the vowels of our language are diphthongs, and consist of two vocal sounds, or vowels, pronounced in quick succession; these diphthongs are discovered by prolonging the sound, and observing, if the ending of it be different from the beginning; thus the vowel i in our language, as in the word high, if drawn out ends in the sound of the letter e as used in English; which is expressed by the letter i in most other languages; and the sound of this vowel i begins with ah, and consists therefore of ah and ee. Whilst the diphthong ou in our language, as in the word how, begins with ah also, and ends in oo, and the vowel u of our language, as in the

word use, is likewise a diphthong; which begins with e, and ends with oo, as eoo. The French u is also a diphthong compounded of a and oo, as aoo. And many other defects and redundancies in our alphabet will be seen by perusing the subsequent structure of a more perfect one.

The alphabet appears from an analysis of it to consist of thirty-one letters, which spell all European languages.

Three mute consonants, P, T, K.
Three antesonant consonants, B, D, Ga.
Three narisonant liquids, M, N, NG.
Six sibilants, W German, F, Th, S, Sh, H.
Six sonisibilants, W, V, Th, Z, J French, Ch Spanish.
Two orisonant liquids, R, L.
Eight vowels, Aw, ah, a, e, i, y, oo, o.

To these thirty-one characters might perhaps be added one for the Welsh L, and another for whistling with the lips; and it is possible, that some savage nations, whose languages are said to abound with gutturals, may pronounce a mute consonant, as well as an antesonant one, and perhaps another narisonant letter, by appressing the back part of the tongue to the back part of the palate, as in pronouncing the H, and Ch Spanish.

The philosophical reader will perceive that these thirty-one sounds might be expressed by fewer characters referring to the manner of their production. As suppose one character was to express the antesonance of B, D, Ga; another the orisonance of R, L; another the sibilance of W, S, Sh, H; another the sonisibilance of W, Z, J French, Ch Spanish; another to express the

more open vowels; another the less open vowels; for which the word micron is here used, and for which the word mega is here used.

Then the following characters only might be necessary to express them all; P alone, or with antesonance B; with narisonance M; with sibilance W German; with sonisibilance W; with vocality, termed micron OO; vocality, termed mega O.

T alone, or with the above characters added to it, would in the same manner suggest D, N, S, Z, EE, Y, and R, with a mark for orisonance.

K alone, or with the additional characters, would suggest Ga, NG, Sh, J French, A, E, and L, with a mark for orisonance.

F, alone, or with a mark for sonisibilance, V.

Th alone, or with a mark for sonisibilance, Th.

H alone, or with a mark for sonisibilance, Ch Spanish, and with a mark for less open vocality, aw, with another for more open vocality, ah.

Whence it appears that six single characters, for the letters P, T, K, F, Th, H, with seven additional marks joined to them for antesonance, narisonance, orisonance, sibilance, sonisibilance, less open vocality, and more open vocality; being in all but thirteen characters, may spell all the European languages.

I have found more difficulty in analyzing the vowels than the other letters; as the apertures, through which they are modulated, do not close; and it was therefore less easy to ascertain exactly, in what part of the mouth they were modulated; but recollecting that those parts

of the mouth must be more ready to use for the purpose of forming the vowels, which were in the habit of being exerted in forming the other letters; I rolled up some tin foil into cylinders about the size of my finger; and speaking the vowels separately through them, found by the impressions made on them, in what part of the mouth each of the vowels was formed, with somewhat greater accuracy, but not so as perfectly to satisfy myself.

The parts of the mouth appeared to me to be those in which the letters P, I, K, and H, are produced; as those where the letters F and Th are formed, do not suit the production of mute or antesonant consonants; as the interstices of the teeth would occasion some sibilance; and these apertures are not adapted to the formation of vowels on the same account.

The two first vowels aw and ah being modulated in the back part of the mouth, it is necessary to open wide the lips and other passages of the mouth in pronouncing them; that those passages may not again alter their tone; and that more so in pronouncing ah, than aw; as the aperture of the fauces is opened wider, where it is formed, and from the greater or less size of these apertures used in forming the vowels by different persons, the tone of all of them may be somewhat altered as spoken by different orators.

I have treated with greater confidence on the formation of articulate sounds, as I many years ago gave considerable attention to this subject, for the purpose of improving shorthand; at that time I contrived a wooden mouth with lips of soft leather, and with a valve over

the back part of it for nostrils, both which could be quickly opened or closed by the pressure of the fingers, the vocality was given by a silk ribbon about an inch long and a quarter of an inch wide, stretched between two bits of smooth wood a little hollowed; so that when a gentle current of air from bellows was blown on the edge of the ribbon, it gave an agreeable tone, as it vibrated between the wooden sides, much like a human voice. This head pronounced the p b m and the vowel a, with so great nicety as to deceive all who heard it unseen, when it pronounced the words mama, papa, map and pam; and had a most plaintive tone, when the lips were gradually closed. My other occupations prevented me from proceeding in the further construction of this machine; which might have required but thirteen movements, as shown in the above analysis, unless some variety of musical note was to be added to the vocality produced in the larynx; all of which movements might communicate with the keys of a harpsichord or forte piano, and perform the song as well as the accompaniment; or which, if built in a gigantic form, might speak so loud as to command an army, or instruct a crowd.

I conclude this with an agreeable hope, that now war is ceased, the active and ingenious of all nations will attend again to those sciences, which better the condition of human nature; and that the alphabet will undergo a perfect reformation, which may indeed make it more difficult to trace the etymologies of words, but will much facilitate the acquisition of modern languages; which, as science improves and becomes more generally diffused, will gradually become more distinct and accurate than the ancient ones; as metaphors will cease to be necessary in conversation and only be used as the ornaments of poetry."—Dr. DARWIN.

The Kaleidoscope,

An instrument invented by Dr. Brewster, of Edinburgh. Obtain three pieces of glass, eight inches in length, and one in breadth. Blacken one side of each with paint. Form a triangle with them, having the painted sides outward; insert them into a tin tube, made exactly to receive them, but half an inch longer; fit a round piece of glass into the other end, and also another piece of ground glass into a lid or slide half an inch long, made to fit into the end of the tube exactly. Before you fit on this small slide, put ten small bits of variously coloured glass into the same end. Let the other end be closed with tin through which there is an aperture of a quarter of an inch, to look through; move the tube round with your hand, which will cause the bits of coloured glass to present many pleasing configurations to the eye. "It would be an endless task to point out the various purposes in the ornamental arts to which the Kaleidoscope is applicable. It is useful to architects, painters, plasterers, jewellers, carvers and gilders, carpet manufacturers, manufacturers of pottery, cabinet makers, wire workers, bookbinders, calico printers, weavers of fancy goods, &c. &c."

12 How many different views will an instrument of ten bits present?

$1\times2\times3\times4\times5\times6\times7\times8\times9\times10=3628800$.—Ans.

13 How many views will a Kaleidoscope present, containing 18 bits of glass, each bit of a different hue?

$1\times2\times3\times4\times5\times6\times7\times8\times9\times10\times11\times11\times12\times13\times14\times15\times16\times17\times18=6402373705728000$.—Ans.

The Myriorama

Of Mr. Clark, consists of fragments of landscapes, neatly coloured, and so ingeniously contrived, that any two or more placed together will form a pleasing view, or if the whole are put on a table at once, will admit of the astonishing number of 20,922,789,888,000 variations.

15 How many cards are there in the box?

$$1\times2\times3\times4\times5\times6\times7\times8\times9\times10\times11\times12\times13\times14\times15\times16 = 20{,}922{,}789{,}888{,}000.$$

Thus it appears that there are sixteen cards.

N. B. His second series, consisting entirely of Italian scenery, extends to the incredible number of 620,448,401,733,239,439,360,000.

16 How many cards are there in the box?

Ans.—24.

14 Supposing the moon a hollow sphere, 2160 miles in diameter, and full of ale, how soon would 30,000 taps, capable of discharging a gallon each per second, empty her?

1760 yards in 1 mile
3

5280 feet
2160 miles in the m.'s diam.

316800
5280
10560

11404800 ft. in the moon's diam.

11404800
11404800
912384
456192
4561920
114048
114048
130069463040000
11404800
104055570432
52027785226
520277852260
13006946304
13006946304
1483416212078592000000
,5236
8900497272471552
4450248636235776
2966832424157184
741708l060392960

cubic feet 7767167286443507712000000 cut off for dec.
reckon 6 gals. in 1 solid foot

3)4660300371866104627200 divide this by 30000

6 0)155343345728870157 4 seconds

6 0)2589055762147835 minutes

24 { 4)43150920362133 hours
6)10787732342282

365)1796955390380 days

5,000,000,000 years nearly

Ans.—In five thousand millions of years.

17 Suppose that the surface of water and land on our globe are in proportion to each other as two to one. Again, suppose the sea of an equal depth throughout, (say one mile), and its surface to the land as one to one. How soon would a syphon capable of discharging 1000 cubic feet per second, empty the sea?

Let us suppose the side of a square equal to $\frac{1}{3}$ of the earth's surface, to be 8000 miles, as it is nearly, then reduce it into feet.

8000
5280

feet 42240000² sq. this number & multiply by the ft. in a mile
1000 5280

31557600)9420668928000,000(000
sec. per yr.
300,000,000

It appears that it would require three hundred millions of years.

18 In how many generations could the inhabitants of the world drink the sea dry?

In every cubic foot of liquid, let us say there are six gall onsand six forty-sevenths (thus $6\frac{6}{47}$) there will therefore be 57,726,652,154,553,191,489 gallons in the sea. And if every person, one with another, be estimated to consume a gallon per day, in a generation (thirty years) 8,760,000,000,000 gallons would be consumed, therefore divide the one by the other, and you will obtain 6,000,000 of generations.

19 Have all the waters of the sea been taken up by evaporation since the world was created?

Supposing for a round number there are 120,000 square miles of water on this globe, and every four square feet to evaporate a gallon per day, as is found by experiment to be the case, the annual evaporation would be as under.

4)27 878 400 square feet per mile

6,969,600 Gals. evap. per square mile daily.
120,000

836,352,000,000 Gals. evap. daily on the globe
multiply by 365 days per year

305,278,480,000,000 Annual evap. on the globe.

By the former question we see there are 57,726,652,154,553,191,489 gallons in the sea, therefore we must divide for the Answer.

305278480000000)57726652154553191489(180000
305278480000000

2719880415455319
2442227840000000

and so on.

We here see that it requires upwards of one hundred and eighty thousand years to evaporate all the waters in the sea, and as the age of the world is only 6000 years, consequently one thirtieth part of the waters of the sea have been evaporated and no more.

Gravity.

When a child, & unacquainted with the laws of motion, attraction, and gravity, as soon as told of the movement of the earth in her orbit round the sun, and of her diurnal motion, I imagined if any body could be detached from the earth, it must fall either in some other country from the diurnal rotation, or be left in space, from the earth's annual motion in her orbit, not considering that the throwing of a stone and the flight of birds defeat these ideas. Aeronauts seem to have similar ideas when they let bodies fall from great heights. Gravity operates in different directions, upwards and downwards, and horizontally.

Let the above diagram illustrate the doctrine of gravity. Let the outward and inner circles be made of wire; let them be connected together by solder, with four straight pieces exactly at right angles to each other; let four balls slide on the wires, and let strings be tied to loops attached to the balls; put the strings through the interior circle and draw; thus they all approach the centre at once. Conceive the four wires to represent four pits dug from the surface of this earth to its centre, and let a stone be dropped into each pit at the same

moment the stone at top falls down, but the stone at bottom seems to fall upwards, if I may be allowed the expression, while the other two fall horizontally, and yet they all fall to the centre, where the weight or gravity is O.

Gravity and weight seem to be synonimous terms in some cases. "The force of gravity is greatest at the earth's surface, from whence it decreases both upwards and downwards. Upwards, the force of gravity decreases as the square of the distance from the centre increases, but below the surface of the earth, the force of gravity decreases, so that at the distance of half a semidiameter from the centre, it is but half what it is at the sursace, at one-third of the semidiameter, one-third, and so on for any other assumed distance. We say such a piece of lead weighs a pound, but if by any means it could be carried 4000 miles above the surface of the earth, it would only weigh four ounces, and provided it could be removed 8000 miles above the earth's surface, it would weigh only one-ninth of a pound.

Again since the force of gravity downwards decreases as the distance from the surface increases, 16 ounces would weigh at one half the distance from the centre to the surface only eight ounces, and so on for one-third, &c.

Hence a piece of metal, &c. weighing on the surface of the earth one pound, will

At the centre weigh....	0	
1000 miles from the centre	quarter of a pound.	
2000 do.	do.....	half do.
3000 do.	do.....	three-quarters do.
4000 do.	do.....	one pound.
8000 do.	do.....	quarter do.
12000 do.	do.....	one-ninth do.

ALTITUDES.—*Barometer.*

The Barometer is an useful instrument in ascertaining the height of a mountain. Every one-tenth of an inch of Mercury is equal to 103 feet; therefore for every 103 feet you rise in ascending any mountain, the mercury in the barometer tube descends one-tenth of an inch.

20 Hence, determine the height of Snowden, in Wales, in ascending to the top of which the mercury sinks 3,67 inches?

3,67
103

1101
3670

378,01
10

Ans.—3780,10 feet, the height.

Puy de Domme experiment

is a term under which the celebrated experiment of Pascal is spoken of, and by which the pressure of the atmosphere was demonstrated beyond every possible objection. It was some time after Torricelli had first asserted the pressure of the atmosphere, before philosophers could divest themselves of their prejudices on this head.—Some asserted one thing and some another as to the suspension of the mercury in the barometer tube. Pascal at length suggested, that if the pressure of the atmosphere was the real cause, mercury ought to sink on ascending a high mountain. In ascending the Puy de

Domme mountain, the mercury sunk, and in descending rose again, which left no doubt in the mind of Pascal as to the real cause of suspension.

If a barometer be put under the receiver of an air pump, and the air extracted, the mercury will fall, but when the air is again admitted, it rises, which is another proof.

21 The shaft of Pompey's Pillar is a single stone of granite, whose perpendicur altitude is 90 feet, the diameter at the base 9 feet, and at the top 7 feet 6 inches; required its solidity?

RULE.—Divide the difference of the cubes of the two diameters, by their difference; multiply the quotient by ,7854, & then again by $\frac{1}{3}$ of the height, for the solidity.

9^3	$7{,}5^2$	9,0
		7,5
729	421,875	—
subtract 421,875		1,5

1,5)307,125(204,75
,7854

160,81065
30 = $\frac{1}{3}$ of 90

Ans.—4824,31950 solidity.

"Pompey's Pillar is situated near Alexandria in Egypt. It is a fine regular column, of the Corinthian order; and its whole height, including the capital and pedestal, is 114 feet. Upon its top has been a statue, which must have been of a gigantic stature, to have appeared of the ordinary size of a man, to a spectator at the bottom.

The remains of this statue, consisting of a foot and an ancle, were only discovered about 40 years ago, by some *jolly sons of Neptune*, that ascended the pillar, and drank a bowl of punch upon the top of it, amidst the shouts and acclamations of the natives, who were astonished at the *address* and *boldness* of the *British Tars*.

This object they accomplished by means of a rope which they contrived to draw over the top of the pillar, by the assistance of a paper-kite. One of the company then ascended; and a kind of shroud being constructed seven persons more went up: and the whole descended again, without the least accident, except the falling of a portion of the capital, which they carried off in triumph."—NESBIT.

But what is this pillar when compared with the Giant's Causeway, and those which Bruce describes in his travels. See his travels, vol. 4, p. 553.

"The Giant's Causeway, in Ireland, stands conspicuous. It consists of three piers of basalt columns, which extend some hundred feet into the sea, surrounded by precipitous rocks, from 200 to 400 feet high, in which there are several striking assemblages of columns, some vertical, some bent or inclined, and some horizontal, and as it were driven into the rock. Bengore, which bounds the Causeway on the east, consists of alternate ranges of tabular and massive, with columnar basalt. But among the various and grand objects on this coast, Pleskin is perhaps the most striking. it presents several colonnades of great height and regularity, separated from each other by tabular basalt; and at Fairhead, the north-east cape of Ireland, and forming the east side of Ballycastle Bay, there is a range of columns of from ten

to twenty feet diameter, and between 200 and 300 feet high, supported upon a steep declivity, and offering to the mariner at sea the spectacle of a terrace, which towers nearly 600 feet above the waves that rol beneath."

We were, says Bruce, at once surprised and terrified by a sight surely one of the most magnificent in the world. We saw a number of prodigious pillars of sand sometimes, moving with great celerity, sometimes with majestic slowness; at intervals we thought they were coming to overwhelm us. About noon they began to advance with considerable swiftness upon us, hiding their heads in the clouds. Eleven ranged along side of us, but returned, leaving an impression upon my mind to which I can give no name, it was in vain to think of flying; the swiftest horse or fastest sailing ship were of no avail.

On a following day a greater number appeared; they darkened the sun. Our people said it was the day of judgment; Ismael pronounced it hell; and the Turcories said the world was on fire.

Pyramids.

At Memphis, in Egypt, are three pyramids, the four faces of the largest look to the four cardinal points of the compass: each face has a base of 220 yards, and each face forms an equilateral triangle; on how many acres of ground does it stand?

220 yards
220

4400
440

4840)48400(10 acres.
48400

N. B. The cardinal points of the compass are east, west, north, and south. Dr. Robertson says, in his history of America, page 12, while this spirit was gradually forming in Europe, a fortunate discovery was made, which contributed more than all the efforts and ingenuity of preceding ages to improve and to extend navigation. That wonderful property of the magnet, by which it communicates such virtue to a needle or slender rod of iron as to point towards the poles of the earth, was observed. The use which might be made of this in directing navigation was immediately perceived. That valuable, but now familiar instrument, the *mariners' compass*, was constructed. When by means of it navigators found that, at all seasons and in every place, they could discover the north and south with so much ease and accuracy, it became no longer necessary to depend merely on the light of the stars and the observation of the seacoast. They gradualy abandoned their ancient timid lingering course along the shore, ventured boldly into the ocean, and, relying on this new guide, could steer in the darkest night, and under the most cloudy sky, with a security and precision hitherto unknown. The compass may be said to have opened to man the dominion of the sea, and to have put him in full possession of the earth by enabling him to visit every part of it. The art of steering by the compass with such skill and accuracy as to inspire a full confidence in its direction, was acquired gradually. Sailors unaccustomed to quit the sight of land, durst not launch out at once and commit themselves to unknown seas. Accordingly, near half a century elapsed from the time of Gioia's discovery, before navigators ventured into any seas which they had not been accustomed to frequent.

The Pyramids of Egypt have been considered from time immemorial, among the most stupendous wonders of the world; and no one can doubt that in strength and elevation they are superior to any other monuments that art can boast. Of these venerable buildings the most

remarkable are the three pyramids of Memphis The dimensions of the largest of them have been variously estimated. According to Greaves, its perdendicular elevation is 499 feet, and its oblique height 625 feet, which latter is the measure of its base. Its four facse look aowards the four cardinal points of the compass: each face has a base of 110 fathoms, and each face forms an equilateral triangle. It results from these dimensions, and from the latitude under which this pyramid is raised, that, fourteen days before the spring equinox, (the precise epoch in which the Persians celebrated the renewing of nature,) it would cease to throw any shadow at mid-day, and that it would not project any shadow again (at mid-day) until fourteen days after the autumnal equinox; consequently, the day on which the sun's southern declination was 5 deg. 15 min. (which happened twice a year—once before the vernal equinox, and once after the autumnal equinox,) the sun would appear at mid-day precisely upon the very pinnacle of the pyramid. His majestic disk, placed upon that immense pedestal, would seem to repose upon it for some minutes, whils his adorers, kneeling down at its foot, prolonging their view along the inclined plane of the northern pyramid, contemplated the great Osiris, either as he descended into the shade of the tomb, or as he rose triumphant out of it. It would appear that the Egyptians, ever great in all their designs, had executed a project, the most daring which imagination could conceive, that of placing a pedestal for the sun and for the moon, or for Osiris and Isis, at mid-day for the one, and at midnight for the other, when they arrived in that part of the heavens near which the line passes that separates the northern from the southern hemisphere, the reign of good from the reign of evil, the empire of light from the empire of darkness.—Dr. JAMIESON.

End of Part First.

C. CRABTREE, PRINTER, KEIGHLEY.